UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

April 30, 2003

Daniel M. Mathis, P.E.
Division Administrator
Federal Highway Administration
Suite 501 Evergreen Plaza
711 South Capitol Way
Olympia, Washington 98501-1284

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Hood Canal Bridge Retrofit and East Half Replacement Project (WRIAs 15, 17 and 18)(2002-00546).

Dear Mr. Mathis:

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. 1531, *et seq*. and Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, the attached document transmits NOAA's National Marine Fisheries Service (NOAA Fisheries) Biological Opinion (Opinion) and MSA Essential Fish Habitat (EFH) Consultation. These consultations are based on NOAA Fisheries' review of a proposal to fund a project to replace the east half of the Hood Canal bridge, and widen the west half. The Federal Highway Administration (FHWA) determined that the proposed action was likely to adversely affect the Puget Sound chinook (*Onchorynchus tshawytscha)* and Hood Canal summer-run chum (*O. keta*) Evolutionarily Significant Units, and requested formal consultation. NOAA Fisheries concurred with this determination, and initiated formal consultation on January 2, 2003.

This Opinion reflects the results of a formal ESA consultation and contains an analysis of effects covering the above listed species in Hood Canal, Port Angeles, Elliott Bay and Commencement Bay. The Opinion is based on information provided in the Biological Assessment and addenda, site visits on August 7, 2002 and January 14, 2003, and additional information transmitted via telephone conversations and e-mail. A complete administrative record of this consultation is on file at the Washington Habitat Branch Office.

NOAA Fisheries concludes that implementation of the proposed project is not likely to jeopardize the continued existence of Puget Sound chinook or Hood Canal summer-run chum salmon. In your review, please note that the incidental take statement, which includes Reasonable and Prudent Measures and Terms and Conditions, was designed to minimize take.

The MSA consultation concluded that the proposed project may adversely impact designated Essential Fish Habitat (EFH) for groundfish. Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries has made conservation recommendations intended to minimize the adverse effects of this action to designated EFH.

If you have any questions, please contact John Stadler of the Washington Habitat Branch at (360)753-9576 or via email at John.Stadler@noaa.gov.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Enclosure

cc: Jeff Sawyer, WSDOT
Ken Berg, USFWS

Endangered Species Act - Section 7 Consultation
Biological Opinion

and

Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

NOAA Fisheries No. 2002-00546

Hood Canal Bridge Retrofit and Replacement Project
Kitsap, Jefferson, Clallam Counties

Agency: Federal Highway Administration

Consultation Conducted By: National Marine Fisheries Service
Northwest Region

Issued by: For Michael R Crouse   Date: April 30, 2003

D. Robert Lohn
Regional Administrator

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1.0 INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with NOAA's National Marine Fisheries Service (NOAA Fisheries) to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats. In addition to the ESA, the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Federal agencies are required to consult with NOAA Fisheries when their actions may have an adverse effect on EFH.

This document contains the Biological Opinion (Opinion), the product of an interagency consultation pursuant to Section 7(a)(2) of the ESA and implementing regulations found at 50 CFR 402. This document also contains the results of the EFH consultation, pursuant to Section 305(b) of the MSA, and implementing regulations for EFH found at 50 CFR 600.

The Federal Highway Administration (FHWA) proposes to provide funding to the Washington State Department of Transportation (WSDOT). The purpose of the funding is to replace the east half, and widen the west half, of the floating bridge across Hood Canal (HC), in Kitsap and Jefferson Counties, Washington.

1.1 Background and Consultation History

On May 20, 2002, NOAA Fisheries received a preliminary Biological Assessment (BA) and an EFH Assessment for the proposed project, and a request for ESA section 7 and EFH consultation from the FHWA. The FHWA concluded that the action is Likely to Adversely Affect (LAA) Puget Sound (PS) chinook (*Oncorhynchus tshawytscha*) and Hood Canal Summer-Run (HCSR) chum (*O. keta*). NOAA Fisheries submitted a formal request for additional information on June 25, 2002, and additional discussions occurred through a series of project team meetings and electronic mail messages. A revised BA/EFH Assessment was delivered to NOAA Fisheries on January 2, 2003. However, there remained a few outstanding information needs which were not addressed in the revised BA, and an informal request was provided to the FHWA on January 9, 2003. Considering the urgent nature of the project, and with the understanding that the requested information was forthcoming, NOAA Fisheries initiated formal ESA consultation and EFH consultation, as of the date of receipt of the revised BA/EFH Assessment (January 2, 2003). The additional information was provided, in the form of BA addenda on January 29, February 10, February 28 and April 15, 2003. A complete administrative record of this consultation is on file at the NOAA Fisheries office in Lacey, WA.

The objective of the Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of PS chinook and HCSR chum, both listed as threatened under the ESA. The standards for determining jeopardy are described in section 7(a)(2) of the ESA and further defined in 50 CFR 402.14. The term "salmonids" refers to both PS chinook and HCSR chum. The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and, if so, to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects on EFH. Both consultations are based on information provided in the BA, BA addenda and correspondence with the applicant via numerous meetings, post and electronic mail (email).

1.2 Description of the Proposed Action

This project proposes to reconstruct the east half of the Hood Canal Bridge (Figure 1) to current design standards and make improvements to the remainder of the structure. The bridge will be designed to wind, wave, and seismic standards. It will feature two 12-foot traffic lanes and 8-foot shoulders to improve safety and mobility. A new drawspan will reestablish the 600-foot opening for large vessels that pass through the bridge.

The proposed project will consist of four major elements: (1) replacement of the east half of the floating structure including anchors; (2) replacement of the east and west approach spans; (3) replacement of the east and west steel truss transition spans; and (4) widening of the west half of the bridge to accommodate 8-foot shoulders.

Both the east and west transfer spans will be built at an off-site location. After the trusses are brought onsite with barges, the old structures will be removed and the new structures will be put in place using barge-mounted cranes.

The primary project elements are located in Jefferson and Kitsap Counties, Washington. The project site is the entire length of the Hood Canal Bridge - State Route (SR) 104, Milepost (MP) 13.93 to 15.42. The project will be conducted in a portion of the NE ¼ of Section 2, Township 27N, Range 1 E to the NE ¼ of Section 12, Township 27N, Range 1E WM.

Secondary project features are located in Township 27N, Range 1E, Section 16 (South Point ferry terminal), Township 28N, Range 1E, Section 32 (Fred Hill/Shine park and ride), and Township 27N, Range 2E, Section 5 (Port Gamble pedestrian only ferry and park and ride).

The Port Angeles graving dock site is located in the town of Port Angeles, Clallam County, and is bounded by Marine Drive and Port Angeles Harbor between Hill Street and the Daishowa America paper mill. Property at the graving dock location is both owned by the Port of Port Angeles and leased by the Port from the Washington State Department of Natural Resources (WDNR).

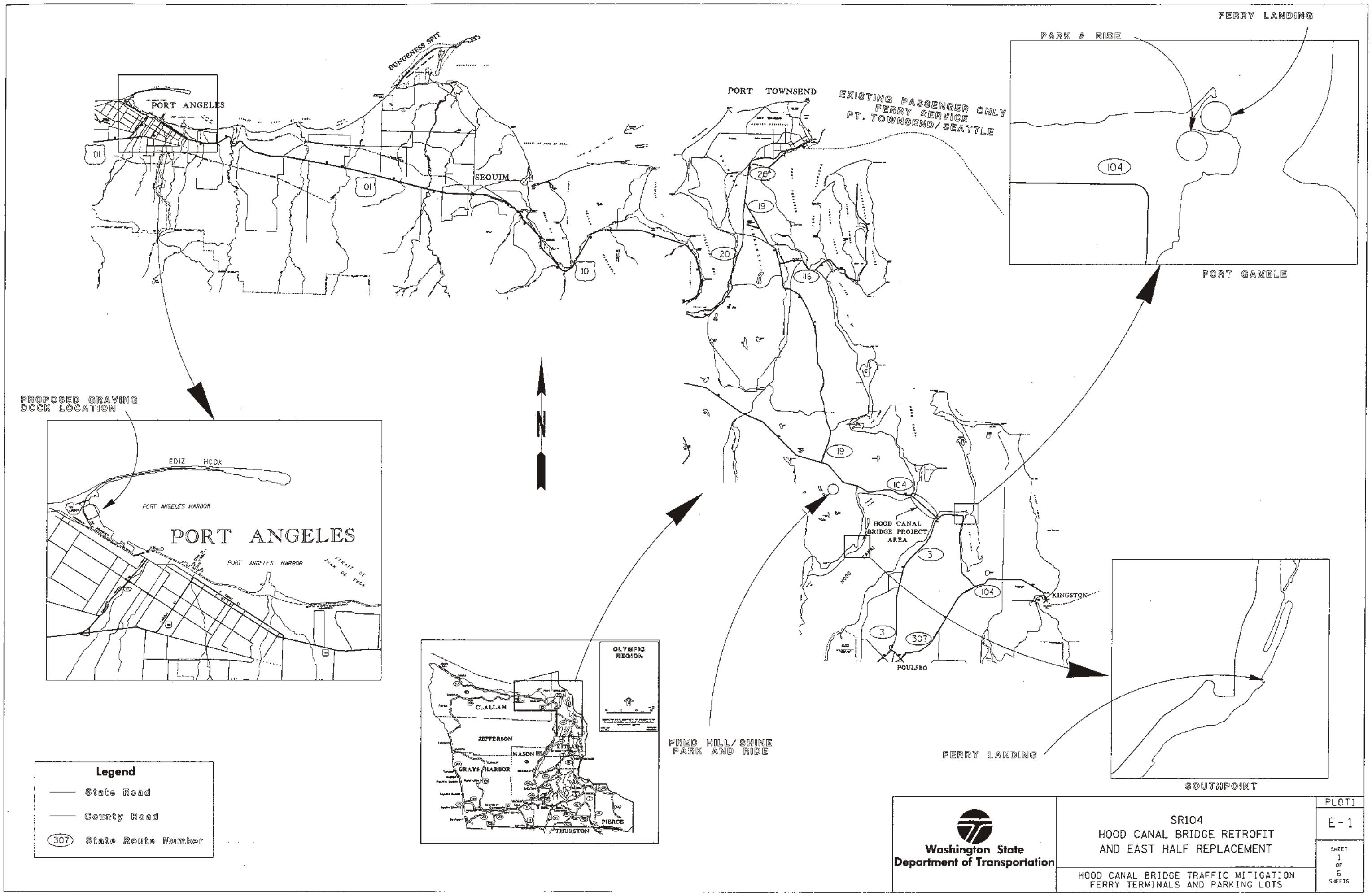

Figure 1.1: Hood Canal Bridge, POF Terminals, and Graving Dock Vicinity Map

1.2.1 Hood Canal Bridge Construction Activities

Five primary elements of in or over water construction are described in the following sections. They include: (1) new anchor placement for floating bridge sections; (2) constructing drilled shaft foundations for both approach spans; (3) construction of approach roadway structures; (4) construction and replacement of the east half of the floating structure; and (5) widening of west half of floating structure.

1.2.1.1 Bridge Anchors

The existing floating bridge structure is held in place by concrete anchors filled with gravel or crushed rock ballast. The anchors are attached to the bridge pontoons with large steel cables that can be adjusted as needed to provide optimal bridge stability. Part of the east half of the floating bridge replacement will include the installation of 20, 28-foot high cylindrical concrete anchors: 14 will be 46 feet diameter; five will be 56 feet diameter; and one will be 56 feet diameter with a 60-foot base. The 20 anchors will cover a total of 0.88 acres of substrate in HC at depths of up to approximately 350 feet.

The new anchors and 3-inch diameter anchor cables will be brought to the project site and set in place one year before the floating structure is brought to the site. Anchors will be towed to the site by tugboats and carefully set into place (sunk with ballast) at depths to 345 feet. Cable blocks will be used to lower the gravity anchors to the canal bottom after the ballast has been placed in the shell. Floats are attached to a transponder used for positioning the anchor on the bottom and for relaying the tilt in all directions. A computer will be used to keep track of the ballast, anchor position and data on block load changes as the anchor is placed on the bottom. The anchor cables will be installed with the anchors and tagged with surface buoys marking the ends.

The existing anchors and ballast will remain where they are presently located on the bottom of HC. The existing cables will be removed.

1.2.1.2 Drilled Shafts

The east and west approach spans are to be supported by piers, set on large-diameter drilled shaft foundations. The existing east approach span is approximately 640 feet long and is supported by seven piers on relatively shallow spread footings. The project proposes to remove the seven east-side piers and replace them with six new support piers using two drilled shaft foundations per pier.

On the west end of the bridge there are three existing piers. The new configuration includes removing two piers and constructing one new replacement pier on the west end of the approach and one new pier tied into the large existing pier, which will remain.

Because some of the drilling will occur at or below the water level of HC, all large-diameter shafts will be constructed using a combination of permanent and temporary steel casings in conjunction with the wet method of excavation (*i.e.*, excavating through a slurry filled casing). The casing is used to contain the slurry and drilling spoils, and to aid in the prevention of cave-ins during shaft excavation.

The general procedure for drilling the shafts is as follows:

- Casings will be installed using a vibratory equipment. If obstructions are encountered, then shaft excavation equipment (*i.e.*, augers or core barrels) will be employed to excavate and relieve each obstruction before continuing.
- The shafts will be excavated under slurry using conventional shaft drilling tools.
- The shafts will be cleaned in preparation for concrete placement.
- A reinforcing steel cage will be installed, and concrete poured through a tube, starting at the bottom of the shaft and displacing the slurry from the bottom up.
- The slurry will be pumped off the top of the shaft as it is displaced by concrete, and returned to holding tanks where it will be reconditioned for the next shaft as the concrete is placed. After all shaft construction is complete, the slurry will be hauled off-site in the holding tanks for disposal.
- The excavated material from the shafts (*i.e.*, material removed from the shafts during excavation) will be contained in dump trucks or on a spoils barge, then removed from the site for upland disposal.

1.2.1.3 Road Approaches

After the drilled shaft foundations are constructed, new columns and crossbeams will be constructed under the existing roadway superstructure. Temporary crossbeam extensions will then be constructed next to the existing roadway (using the new foundations as supports) where the new roadway will be constructed onsite. The new superstructure will be built on the temporary crossbeam extensions. Once the existing approach structure is demolished, the new superstructure can be slid into place, the rollers removed, the diaphragms attached, and the expansion joints installed. The last step will be to remove the temporary crossbeams.

1.2.1.4 East Half Replacement

The existing floating bridge structure consists of the roadway superstructure and large concrete pontoons approximately 18 feet in height. Each pontoon is approximately 60 feet wide by 360 feet long, and together they provide the foundation for the roadway superstructure and a work platform for bridge operations and maintenance. When the west half of the bridge sank and was replaced in the early 1980s, the east half remained intact and was not replaced. Thus, this project will include the replacement of the east half of the floating structure but not the western portion.

The proposed new floating structure will consist of 16 pontoons, three of which are currently moored in Port Gamble Bay. The three existing pontoons will be floated to a work site in Seattle, Tacoma, or Port Angeles where the new columns, crossbeams, and roadway superstructure will be constructed. The 13 new pontoons will be constructed at the new graving dock facility in Port Angeles. After all new roadway sections and pontoons are completed, they will be floated to the bridge site where they will be joined and anchored. The old bridge pontoons will either be sold or taken to the Port Angeles graving dock and demolished. If sold, the purchaser will be responsible for obtaining all permits and permissions necessary to move/relocate the pontoons. After the new pontoons are in place, the transition spans will be installed using barge-mounted cranes.

1.2.1.5 West Half Widening

Part of the proposed project includes widening the existing roadway by 10 feet on the west half of the floating structure to match the roadway width on the new sections. In order to widen the roadway, portions of the existing rail and roadway deck must be demolished to expose the existing girders so that the new roadway deck can be attached. New steel reinforcement bars will be tied, forms placed, and concrete poured into the forms from the roadway deck. Work on widening the west half will occur over two construction seasons.

All debris from the west half demolition will be contained on the existing pontoon deck and disposed at an approved upland facility. No inwater work is required for the west half widening.

1.2.2.6 Bridge Demolition

Following construction of the new piers and roadway, and demolition of the old roadway structure, the existing concrete piers supporting the approach sections of the bridge will be removed.

The work bridge placed around the piers on the north side and trestles will extend to the piers. Demolition of the piers and superstructure of the old spans will also occur by use of a specialized machine that demolishes concrete. Cranes and trucks will be able to come alongside the bridge to receive the debris.

Current plans are to demolish piers onsite and remove shallow foundations approximately two feet below the substratum. Piers will be cut up in place and hauled away in trucks on the temporary work platform.

Each of the seven east-side pier structures will be removed, with the exception of the deepest, westernmost pier (pier 4), which will be removed only to the top of the existing fender protection. The furthest pier east (pier 10) sits at the junction between the surface roadway and the beginning of the approach span. To prevent erosion and failure of the fill above the pier, sheet pile will be driven behind the back of the pavement seat as a temporary support. The existing embankment will be excavated to allow a new pier to be built in front of the old pier. For the three piers on the west-side approach, existing piers 1 and 2 will be removed. Pier 1 (the westernmost pier) will be removed in a manner similar to that of pier 10 (the easternmost pier). The existing pier three is of different design than the other piers and has been upgraded and stabilized in recent years. Pier 3 will remain intact and will be further retrofitted for use as a partial foundation for one of the new west-side piers.

1.2.2 Preliminary Construction Sequence for the Bridge Structure

Construction of the project will be spread out over four construction seasons running from June 2003 to January 2007.

Stage 1: July 2003 through October 2005

- Begin off-site fabrication of major structural elements (*i.e.*, pontoons, gravity anchors & anchor cables, steel trusses and A-frames, pre-stressed girders, draw span control systems).
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Stage 2: July 2003 through September 2003

- Construct work trestle at the east approach span.
- Construct new columns on pontoons and crossbeam extensions on west half of the bridge.
- Shift traffic to the north on the west pontoons and draw spans.
- Remove concrete barrier on south side.

Stage 3: September 2003 through November 2004

- Construct east and west approach permanent substructure (shafts, columns, and crossbeams).
- Construct east and west approach temporary crossbeams and columns. These temporary structures are required to slide existing approach and transition structures and make room for the new structures.
- Construct south side superstructure widening on the west half pontoons (girders, diaphragms, deck, and barrier).
- Construct south side superstructure on the west lift spans (stringers, grid deck, and barrier).
- Construct east and west approach superstructure on the permanent/temporary crossbeams north of the existing approach spans (girders, diaphragms, deck, and barrier).
- Rehabilitate three existing pontoons stored at Port Gamble.
- Replace anchor cable draw span.

Stage 4: January 2004 through October 2005

- Shift traffic to the south on the west pontoons and draw spans.
- Construct north side superstructure widening on the west half pontoons (girders, diaphragms, deck, and barrier).
- Construct north side superstructure widening on the west lift spans (stringers, grid deck, and barrier).
- Construct maintenance ramp modifications on the north side of Pontoon K.
- Install gravity anchors and cables for east half pontoons.

Stage 5: March 2006 through May 2006 (Weekend Closure)

- Roll existing approach spans south onto temporary crossbeams.
- Roll new approach spans from the north temporary crossbeams onto the permanent crossbeams.
- Remove existing approach superstructure (after weekend closures).

Stage 6: April 2006 through June 2006 (completed during bridge closure)

- Remove and replace west transition truss and A-frame.
- Remove east pontoons, superstructure, and east transition truss.
- Install east transition truss and east pontoons.
- Connect anchor cables between pontoons and gravity anchors.
- Remove abandoned anchor cables on the east half.

Stage 7: June 2006 through January 2007

- Construct mechanical/electrical and control system upgrade on west draw pontoons and lift span.
- Remove temporary crossbeams and work trestles.
- Demobilize.

1.2.3 Secondary Project Features

The secondary elements of construction are described in the following sections. They include: (1) the graving dock facility construction; (2) graving dock operation; (3) anchor and pontoon fabrication; (4) anchor and pontoon moorage; (5) construction of the temporary work platform; (6) staging areas; (7) aggregate sources; (8) waste sites; and (9) the bridge closure mitigation plan. Several aspects of the proposed construction could result in environmental impacts; these potential impacts associated with the project are covered in the impacts section of this report.

1.2.3.1 Port Angeles Graving Dock

WSDOT will construct a graving dock on 22.5 acres leased from the Port of Port Angeles to be used for the fabrication of pontoons and anchors. Steel sheet piles will be driven around the perimeter of the dock site to an elevation between minus 65 feet to minus 25 feet, depending on location and soil characteristics. The sheet pile will be driven using a vibratory or impact driver. The area to be sheet piled is 905 feet by 460 feet (9.6 acres). An area, 735 feet by 460 feet (7.8 acres), inside this perimeter will be excavated to an elevation of plus10 feet mean lower low water (MLLW), which is approximately three feet below the current average ground surface elevation. A second area, 170 feet by 460 feet (1.8 acres), will be excavated to an elevation of minus 15.5 feet, or approximately 28.5 feet below the current surface.

Groundwater encountered during this excavation will be treated by Best Management Practices (BMPs) to remove sediments before release to Port Angeles Harbor. A 12-inch thick reinforced concrete floor will be installed over the entire 9.6 acres. Fish retrieval and water pumping systems will be incorporated into the graving dock structure. Temporary sheet piles will be driven in the harbor in front of the gate area to act as a caisson. A 120-foot wide, 20-foot thick, 42-foot high gate will be constructed behind the caisson. The foundation for the gate will be supported by approximately 280, 24-inch diameter steel pipe piles driven to a depth of minus 80 feet MLLW using an impact hammer and then filled with concrete. Existing riprap and gravel material between the gate and harbor will be removed after the gate is completed.

The harbor floor in front of the gate will be dredged, using a clamshell dredge, to an elevation of minus 20.6 feet MLLW to provide sufficient depth for anchor and pontoon removal. 30,000 cubic yards of material will dredged from the channel, transported to a shoreline facility for offloading, and disposed of at an approved upland disposal site. Two thousand cubic yards of riprap will be placed on either side of the dredged channel to stabilize the slopes.

An existing pile-dolphin in the harbor will be removed and relocated approximately 60 feet to the northwest. The new dolphin will consist of three 24-inch steel piles with a cast in place concrete cap. The piles will be installed with an impact hammer.

Fire hydrants will be placed on either side of the water gate and at each corner of the dock in conformance with city fire regulations. An earthen berm will be constructed around three sides of the dock, supporting a 30-foot wide all weather road.

About five acres upland of the graving dock site will be used as a staging area for parking and for aggregate and steel storage. Approximately three acres of this area is already covered with asphalt or concrete and the remaining two acres will be paved with asphalt to reduce mud and dust and direct runoff to the treatment pond. Stockpiled materials may be delivered to the site by truck or by barge. An existing pier and a barge docking area are available adjacent to the graving dock site. Existing debris piles will be graded flat to maximize the usable construction staging area. A concrete batch plant may be located on the site.

All construction activities, including running the concrete batch plant, if present, but excluding pile driving, may take place 24 hours a day, seven days a week. Pile driving will be limited to daylight hours. Work dates in Port Angeles Harbor will be limited by fish restrictions as detailed in the Hydraulics Project Approval (HPA) issued by the Washington Department of Fish and Wildlife (WDFW).

1.2.3.2 Anchor/Pontoon Construction In and Out of the Graving Dock

Between December 2004 and March/April 2006 reinforced concrete pontoons and anchors will be fabricated on the floor of the graving dock. When completed, the anchors will be floated out of the dock and moored until ready for placement. The drawspan and lift section pontoons will be removed from the graving dock and towed to a shoreline facility for assembly. The four roadway pontoons will remain in the dock until the superstructure is complete, then removed and towed to the bridge site. As they are completed, the graving dock will be flooded by pumps to float these structures. The gate will then be opened, and a tug will tow them out of the dock and into the harbor at Port Angeles. Flooding will follow a protocol developed by WSDOT, in cooperation with the WDFW and NOAA Fisheries. All applicable screening requirements will be followed during pumping operations.

Each time the graving dock is opened to the harbor, there is the potential for fish to enter the dock. As the graving dock is pumped out, fish could become stranded if measures are not taken to capture and move the fish from the facility. The dock has been designed to facilitate fish removal. The fish will be crowded along 2-foot wide by 3-foot deep channels down each side of the lower section of the graving dock to two sumps that are 4-feet wide by 8-feet long and 3 feet deep. The sumps are lined with steel boxes that have a 2-foot by 3-foot watertight door that is the size of, and lined up with, the channel. The boxes are equipped with removable screened tops, lifting loops and a detachable aeration system so that the boxes can be lifted with a crane once the fish are in them and placed in the bay where they are evacuated.

1.2.3.3 Anchor/Pontoon Moorage

The anchors will be moored until they are required at the HC bridge site. At this time, it is expected that the anchors will be towed directly to the bridge, however, temporary moorage may be necessary. The moorage site is currently not known, but three general locations have been identified: Port Angeles; Elliott Bay; and Commencement Bay. The overwater area of these 20 anchors totals 0.88 acres.

Pontoons U, V, W, and X for the east section of the bridge could be temporarily moored from January 2006 to March/April 2006 (approximately four months). The location (Seattle, Tacoma, Port Angeles) and method (deepwater anchorage, existing docks, existing dolphins) of holding the pontoons is unknown and will be determined by the contractor. The overwater area of these four pontoon sections totals 1.44 acres.

Pontoons R, S, and T for the middle section of the bridge, which are currently moored in Port Gamble Bay, will be transported to a dock or pier (*i.e.*, Port of Port Angeles, Port of Seattle, Port of Tacoma), and moored from August 2005 through December 2005 (approximately five months). During this period the existing superstructure will be dismantled and removed, and the new superstructure added. Although these pontoons will be ready for installation by the end of December 2005, they will not be transported to the bridge project area until March/April 2006. Therefore, they could be moored for an additional four months at an unknown location from January through March/April 2006. The total time that pontoons R, S, and T could be moored at an unknown location is approximately nine months. The overwater area of these three pontoon sections equals 1.24 acres.

Pontoons Q, PA, PB, NA, YE, YD, and YF for the lift section of the bridge will be fabricated within the graving dock between May 2004 and December 2004. Once fabrication is completed, the pontoons will be removed from the graving facility and secured to a dock or pier at one of the three identified areas from January 2005 through March/April 2006 (approximately 16 months). During this time, the pontoons will be assembled into the lift section, which includes buildings, towers, operating machinery and lift units. The assembly phase requires a deepwater port facility, due to the 35-foot draft, once the lift section is completed. Overwater coverage from these pontoons totals 1.87 acres.

All pontoons will be fabricated inside the graving dock with the exception of the drawspan pontoons (pontoons ZC and ZD). The drawspan pontoons (ZC and ZD) will be assembled and outfitted outside the graving dock. These sections will be towed to a permitted industrial waterway area for completion (Seattle, Tacoma, or Port Angeles). The drawspan sections of the bridge potentially will be moored for approximately nine months. The overwater area of these two pontoon sections totals 0.68 acre.

When moored, the overwater area of the anchors and pontoons will total 6.11 acres.

1.2.3.4 Temporary Work Trestle

Replacing the east approach span will require construction activity within the inter-tidal and shallow subtidal zones of HC. The flat shoreline on the east side of the canal creates a large inter-tidal area that the roadway approach must cross before connecting to the floating portion of the bridge. The existing east approach span is approximately 640 feet long and is supported by seven piers on relatively shallow spread footings.

The project proposes to remove the seven east-side piers and replace them with six new support piers using two drilled shaft foundations per pier. In order to install the new approach span and the 12 drilled shaft foundations, and to minimize impacts in the inter-tidal zone, a temporary work trestle will be constructed parallel to, and underneath, the existing approach structure. The work trestle will be constructed on temporary pilings, with a deck of large untreated wood beams to accommodate large equipment. Two segments of the trestle, each approximately 600 feet long, will run on each side of, and parallel to the bridge. Between these parallel sections, and perpendicular to them, five or six segments will be constructed. The total overwater area encompassed by the work trestle is approximately 600 feet long by 235 feet wide (3.24 acres). However, the entire 3.24 acres will not be covered by the trestle, as there is considerable open space between the segments.

Approximately 150 2-foot diameter steel piles will be installed to support the work trestle. Due to substrate conditions at the bridge site, all of the piles will be driven with an impact hammer. Following construction of drilled shaft foundations, installation of the new roadway structure, and demolition of the old piers and roadway, the work bridge and its support piles will be removed.

The bottom of the work trestle will be approximately 14 feet above MLLW. Because of the potential disruption of salmonid migration along the shoreline and potential shading impacts to eelgrass, the bottom of the trestle will be covered with a reflective material. If the reflective material is insufficient to ameliorate shade conditions under the trestle, WSDOT will, in consultation with the resource agencies, prepare and implement a plan to increase light levels under the structure. Determination of the sufficiency of the proposed action (reflective materials) will be based on ambient light monitoring. Monitoring of eelgrass will also occur before and after the project to quantify impacts.

Clearing and grubbing will occur in areas where there will be permanent impacts from construction of the temporary work bridge access area and in the vicinity of the bridge abutment at the east end. A total of 47 trees as well as herbaceous vegetation will be removed from approximately one-half acre. This area will be revegetated following construction. After revegetation use of herbicide (glysophate) may be proposed to ensure establishment of planted materials. Since NOAA Fisheries is not exempting any take for application of herbicides or pesticides, this particular element is not covered in this Opinion.

1.2.4 Staging Areas

1.2.4.1 Hood Canal Bridge Project Site

Construction staging areas will be located at both ends of the bridge and limited to existing paved roadway and maintenance parking areas. Although both staging areas will be located immediately above the canal, extensive soil disturbance will not be required. Several catch basins within the staging areas drain directly to the shoreline of HC. The catch basins will be thoroughly protected with BMPs in conjunction with implementation of the temporary erosion and sediment control (TESC) plan. The west side staging area will be approximately 1.07 acres and the east side 1.41 acres.

The contractor may at their discretion use other sites to stage their activities. The contractor will be required and responsible for obtaining all applicable permits and permissions to use these currently unknown sites.

1.2.4.2 Pedestrian Only Ferry and Park and Ride Sites

It is assumed that any staging of materials or equipment necessary for construction of the passenger ferry terminals and the associated park and ride lots will be done on-site.

1.2.4.3 Port Angeles Graving Dock

About five acres upland of the graving dock site will be used as a staging area, for parking, and for aggregate and steel storage. Approximately three acres of this area is already covered with asphalt or concrete and the remaining two acres will be paved with asphalt to reduce mud and dust and direct runoff to the treatment pond. Stockpiled materials may be delivered to the site by truck or by barge. An existing pier and a barge docking area are available adjacent to the graving dock site. Existing debris piles will be graded flat to maximize the usable construction staging area.

The contractor may, at their discretion, use other sites to stage their materials and activities. The contractor will be required and responsible for obtaining all applicable permits and permissions to use these currently unknown sites.

1.2.5 Aggregate Sources

Aggregate materials for all concrete and asphalt work (*e.g.* construction of anchors, pontoons, staging areas, ferry terminal improvements, park and ride facilities, and final road overlay), will be purchased from permitted and approved gravel mining operations by the contractor. No WSDOT owned aggregate sources will be used for this project.

1.2.6 Waste Sites

Any waste material, debris, or spoils generated as a result of this project (*i.e.*, from casing excavation, bridge demolition, and/or dredging) will be disposed at an approved and permitted upland commercial site. The contractor will be responsible for providing waste disposal sites, and will be responsible for obtaining all permits associated with such sites. If contaminated soils are found within the graving dock area during excavation, the contractor will be directed to deposit the material at a temporary stockpile site adjacent to Place Road. The Place Road pit site is located approximately five miles west of the graving dock location. The site is approximately 7.4 acres in size, is owned by WSDOT and is an active pit. The site is highly disturbed and contains large stockpiles of sand, concrete waste, asphalt, and scrap metal. An unnamed tributary to Coville Creek is approximately 900 feet to the west of the pit. The Elwha River is over one-half mile to the east of the pit. One palustrine wetland is documented within the site.

1.2.7 Bridge Closure Traffic Mitigation & Detour Plan

The HC Bridge is the main transportation link between the North Olympic Peninsula and Kitsap County. Construction will occur over four construction seasons from June 2003 to January 2007 and the bridge will be closed for six to eight weeks between April and June 2006. Closure of the bridge will increase the amount of time and costs required by the traveling public to reach their destination.

The proposed traffic mitigation options will be implemented during the six- to eight-week bridge closure. The traffic mitigation, including park and ride facilities and amenities along with proposed passenger only ferries (POF) facilities, are temporary and designed to minimize the impacts of the closure to the traveling public. No improvements are planned to be made to the road network during the temporary closure. The purpose of the traffic mitigation is to provide alternative transportation modes to the traveling public during the six- to eight-week bridge closure to minimize the socioeconomic impacts to the traveling public. Once the bridge is reopened these temporary facilities will be removed; WSDOT will revegetate these areas, as appropriate, and any leases for use of the properties will be terminated.

Based on WSDOT's evaluation of all the mitigation closure alternatives, WSDOT proposes the following actions to implement during the closure of the bridge.

1.2.7 Hood Canal Pedestrian Only Ferries

WSDOT plans to provide POF service crossing the HC, between South Point (Jefferson County) and Port Gamble (Kitsap County). There will be four POF vessels, each with a capacity for 150 passengers and speeds of 25 knots. Departures will occur approximately every 15 to 20 minutes during peak demand and every 35 minutes during off-peak hours. One vessel will operate 24 hours per day, a second vessel 16 hours per day; and the third and fourth vessels will operate eight hours per day, four hours during the morning westbound peak, and four hours during the afternoon eastbound peak. Service to the public will be offered approximately 16 to 20 hours per day. Four standard (40-foot), 40-passenger shuttle buses will be required at South Point to accommodate 150 passengers to and from the Fred Hill/Shine gravel pit park and ride facilities.

Temporary POF facilities will be constructed at Port Gamble and South Point. The supporting network of park-and-ride lots, which will be developed near each temporary POF facility will allow travelers to park vehicles on each side of HC to facilitate their trips. A description of the facilities and associated park and ride lots is presented below.

1.2.7.1 Port Gamble

At Port Gamble, a temporary POF facility and the supporting park-and-ride lot will be co-located onsite. The temporary POF facility consists of a floating dock, one passenger gangway, and a fixed trestle that will be temporarily installed at Port Gamble. The floating dock (a barge or modular float units) will be approximately 80 to 90 feet long by 20 to 30 feet wide with its seaward edge located in depths of minus 20 feet MLLW. The float will be secured with four 30-inch steel piles allowing the float to move up and down with the tides. One, 8-foot wide by 150-foot-long gangway will connect the float to a new 8-foot wide by 125-foot long pier/trestle constructed on 30 new 12-inch steel piles which leads to the shore facilities. This will provide the necessary capacity for loading and unloading of passengers during the high-volume peak hours.

Adjacent to the POF facility, a transit facility will be developed onshore capable of servicing up to four standard, 40-foot buses in the boarding area. The park and ride facility will have 800 to 1,000 parking stalls. Priority parking stalls for vanpools and carpools may be established. In addition, special shuttles serving medical, population, and employment centers in Kitsap County may service POF patrons. A 15-car passenger pick-up and drop-off area will be provided for travelers not parking a car at the lot. A handicapped parking area, sheltered waiting areas, and portable toilet facilities will be provided. Improvements to the access road serving the site will also be made.

1.2.7.2 South Point

A temporary POF facility consisting of a floating dock, one passenger gangway, and an existing fixed dock/platform will be used at South Point. The floating dock (a barge or modular float units) will be approximately 80 to 90 feet long by 20 to 30 feet wide with its landward edge located in depths of minus 15 feet MLLW. The float will be secured with four 30-inch steel piles allowing the float to move up and down with the tides. One 8-foot wide by 150-foot long gangway, providing two-way pedestrian traffic on and off the float, will connect the float to an existing pier. This will provide the necessary capacity for loading and unloading of passengers during the high-volume peak hours. Proposed passenger amenities include a bus turn-around, a sheltered waiting area, an attendant's building, and portable toilet facilities. No parking is proposed at South Point, buses will shuttle passengers back and forth to a park and ride lot located at the Fred Hill/Shine gravel pit.

1.2.8 Fred Hill/Shine Gravel Pit

A temporary park and ride lot with 800 to 1,200 stalls will be developed at the Fred Hill/Shine gravel pit near South Point. Priority parking stalls for vanpools and carpools will be established. SR 104 will provide access to the park and ride. A transit facility will be developed at the gravel pit capable of servicing up to four standard (40-foot) buses in the boarding area. Moreover, passenger waiting shelters, a 15-car passenger pick-up/drop-off, and a handicapped parking area will be provided.

1.2.9 Construction Methods

Inwater construction for the temporary POF facilities requires installation of a total of eight 30-inch steel piles to anchor floats and 30 12-inch steel piles to support the trestle at Port Gamble. The piling will be installed by either by the vibratory or impact method. Pile installation will occur over a two-month period during the allowable inwater work window as defined by the WDFW.

Pile installation will require the use of a derrick, crane, vibratory hammer and/or impact hammer. A choker is placed around the pile and is lifted into a vertical position by a crane. The pile is lowered into position and set in place. The pile is held steady while the hammer is used to install the pile to the desired tip elevation.

If vibratory installation is used, once the pile has reached the desired tip elevation, or when it reaches resistance, the pile is "proofed" by striking it with an impact hammer. If sediment conditions are not conducive to vibratory installation or when installation requires that piling be installed at an angle (*e.g.*, batter piling associated with the pile moorings to support the float), pile driving will be accomplished with an impact hammer.

After piles are installed, the structures (*i.e.*, trestle, gangways, float, etc.) are installed and connected to the piling. Construction of the temporary POF facilities will require the use of a barge with a crane, tug boats, and work skiffs. The time required to complete construction of the temporary POF facilities is anticipated to occur over a six-month period during the inwater construction window. However, actual inwater construction may only take a matter of a few weeks up to two months. All pile materials will consist of steel or untreated wood.

The piles will be removed with a vibratory extractor and/or by the direct pull and/or clamshell method.

If vibratory extraction is used, a vibratory hammer on a derrick will be activated to loosen the pile, and it vibrates while the crane pulls the pile up. As the pile is extracted and the tip of the pile reaches the surface of the substratum, the vibratory hammer is shut off and the crane lifts the pile vertically onto the barge. For the direct pull method, the pile will be wrapped with a choker cable or chain attached to a crane. The crane pulls directly up on the choker, pulling the pile from the sediment. The pile is then placed on a barge.

If a pile is broken or damaged, clamshell removal may be necessary. For this method, the piles are removed with a clamshell bucket. The clamshell bucket, a hinged steel apparatus, operates like a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls up. The broken piling and stubs are loaded onto a barge.

1.2.10 Habitat Restoration Activities

Habitat restoration activities include: (1) the restoration of 1,000 lineal feet of shoreline by clearing and grading; (2) removing fill and undesirable debris material (*i.e.*, concrete, steel, plastics) from the beach; (3) excavating the vertical face of the shoreline to establish a natural beach profile; (4) restoring the beach surface; (5) placing large woody debris (LWD); seeding the uplands; and (6) maintaining a traffic barrier.

There will be approximately 2,000 square feet of vegetation cleared and grubbed. Existing vegetation consists of saltgrass (*Distichlis spicata*) and small quantities of Queen Ann's lace (*Daucus carota*). The majority of the site has been severely degraded from vehicular activities.

A substantial amount of miscellaneous debris currently exists on site. Small woody debris, cable, concrete chunks, and a concrete boat ramp will be removed from the beach and disposed at an approved upland waste site. In addition, WSDOT will remove 57 creosote-treated piles. The anticipated removal method is direct pull by an excavator working on the beach at low tides.

The LWD, which will be collected from the site before excavation and restoration of the natural beach profile, will be placed back on the beach along the shoreline of the mitigation area. If there is sufficient quantity of LWD onsite, it will be placed behind the first row of LWD. The LWD size and placement will comply with the HPA. Moreover, the area landward of the MHHW (~1.0 acre) will be revegetated with native grass seed.

To avoid disturbance to the area and allow the planted vegetation to become established, motorized vehicles will be prohibited from entering the restoration area. To accomplish this large logs will be placed between the pavement and the restored area for the full length of the project.

1.2.1 Conservation Measures

The FHWA and WSDOT have agreed to implement the following conservation measures in an effort to minimize the likelihood and extent of effects on listed species from bridge construction, the POF facilities, the graving dock facility, and pontoon and anchor moorage. NOAA Fisheries considers these conservation measures to be a part of the proposed project, and included them when analyzing the effects of the proposed action (Section 2.1.3). Most, if not all, of these measures are restated as Terms and Conditions in the attached Incidental Take Statement to ensure the action agency and applicant understand they are mandatory.

1.2.1.1 General Conservation Measures

- Inwater work timing restrictions to protect migrating juvenile salmon are split between four areas, with a February 15 through July 14 restriction in HC (Water Inventory Resource Area (WRIA) 15.9120, 17.9090, 17.9120) and Port Gamble (WRIA 159900). An additional inwater work timing restriction to protect herring spawning beds is set from January 15 through April 14 in HC (WRIA 15) and Port Gamble. The inwater work restriction for the graving dock construction and operation in Port Angeles Harbor (WRIA 18) is also February 15 to June 30.

- The project will fully implement and comply with the conditions specified in the HPAs, obtained from WDFW, for the bridge construction and POF terminals (ST-E1552-01, dated December 26, 2002) and the graving dock (ST-E1558-02, dated March 17, 2003).

- Removal of riparian vegetation will be minimized as much as possible and replanting of riparian vegetation will occur where feasible.

- Barge anchors shall be set and retrieved vertically.

- Anchor cable tension shall be maintained such that the cables do not drag the bed of waters of the state.

- Project activities shall be conducted to minimize sedimentation of the beach area and bed.

- All debris or deleterious material resulting from construction shall be removed from the beach area and bed and prevented from entering waters of the state.

- A containment boom surrounding the work area will be used during pile removal to contain and collect any floating debris and sheen. The contractor will also retrieve any debris generated during construction with a skiff and net.

- Replacement fendering systems shall be constructed of non-toxic materials such as untreated wood, steel, concrete, plastic, rubber, or other non-toxic synthetic or natural materials.

1.2.1.2 Pile Driving and Removal Measures

- Where possible, a vibratory hammer will be used to drive steel piles.

- All piles in temporary work bridges and other project components shall be steel or another non-toxic alternative (such as untreated wood) if approved by the USFWS and NOAA Fisheries (Services) and WDFW.

- The underwater sound pressure levels (SPL) from inwater driving of steel piles with an impact hammer will be monitored. If the recorded sound pressure levels exceed the thresholds agreed upon by NOAA Fisheries, United States Fish and Wildlife Service (USFWS), FHWA and WSDOT, a bubble curtain will be deployed to attenuate the sound pressure. The monitoring plan is being developed and will be approved by NOAA Fisheries prior to the start of pile driving.

- Impact pile driving shall occur at low tide to the greatest extent possible. When piles are driven in the dry, the SPL thresholds do not apply.

- Removed piles, stubs, and associated sediments (if any) shall be contained on a barge. The barge pile storage area shall consist of a row of hay and/or straw bales, or filter fabric, placed around the perimeter of the barge.

- Broken timber piles will be removed from the substrate by use of a clamshell. The clamshell shall grasp the pile in such a way as to minimize disturbance (i.e., it grabs the pile stub, but not the sediments) to the bottom sediments. The size of the clamshell shall not exceed three and a half cubic yards. The clamshell bucket shall be emptied of any material on a contained area on the barge before it is lowered into the water.

- All creosoted material, pile stubs, and associated sediments will be disposed of by the contractor in a landfill which meets the State standards.

1.2.1.3 Eelgrass Protection Measures

- Eelgrass impacts will be avoided, minimized, and mitigated a described in the adaptive management plan in section 2.3.2.4.

- Monitoring of eelgrass impacts and restoration shall be as agreed upon by the Services.

- The contractor shall exercise extreme caution when working in the area indicated on the plans as "eelgrass beds." The contractor shall adhere to the following restrictions during the life of the contract. The contractor shall not:

    - Place derrick spuds or anchors in the area designated as eelgrass.

- Shade the eelgrass beds for a period of time greater than absolutely necessary during the growing season (generally May through August).

- Perform activities, which could cause significant levels of sediment to contaminate the eelgrass beds.

- Conduct activities that may cause scouring of sediments within the eelgrass beds or other types of sediment transfer out of or into the eelgrass beds.

1.2.1.4 Water Quality

- The contractor shall be responsible for the preparation of a spill prevention control and countermeasures (SPCC) plan to be used for the duration of the project. The plan shall be submitted to the Project Engineer prior to the commencement of any construction activities. The contractor will maintain a copy of the plan at the work site. The SPCC plan shall identify planning elements, and recognize potential spill sources at the site. The SPCC shall outline best management practices, responsive actions in the event of a spill or release, and identify notification and reporting procedures. The SPCC shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.

- The SPCC will outline what measures shall be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to gasoline, oils, and chemicals. The contractor shall maintain, at the job site, the applicable spill response equipment and material designated in the SPCC plan including oil absorbent materials to be used in the event of a spill or if any oil product is observed in the water.

- A temporary erosion and sediment control (TESC) plan will be developed and implemented for clearing, vegetation removal, grading, ditching, filling, embankment compaction or excavation. The BMPs in the plan will be used to control sediments from all vegetation or ground disturbing activities.

- WSDOT will comply with water quality restrictions imposed by the Washington State Department of Ecology (WDOE), which specify a mixing zone beyond which water quality standards cannot be exceeded.

- Wash water resulting from wash down of equipment or work areas shall be contained for proper disposal, and shall not be discharged into state waters unless authorized through a state discharge permit.

- Equipment that enters the surface water shall be maintained to prevent any visible sheen from petroleum products appearing on the water.

- There shall be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for reentry into surface waters.

- No cleaning solvents or chemicals used for tools or equipment cleaning shall be discharged to ground or surface waters.

- The contractor shall regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and shall maintain and store materials properly to prevent spills.

- Demolition and construction materials shall not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.

- Standard WSDOT contract language prohibits the disposal of waste, construction, or any materials into the waters of PS or HC, or any other natural water body or groundwater.

- Contractors will be required to adhere to the provisions in the National Pollutant Discharge Elimination System permit.

- Wet concrete shall be prevented from entering waters of the state. Forms and impervious materials shall remain intact until the concrete has cured for at least 72 hours.

- Excess or waste materials will not be disposed of or abandoned waterward of Ordinary High Water (OHW) or allowed to enter waters of the state.

- To minimize suspension of sediments and associated turbidity, a clamshell bucket will be used to dredge the entrance channel to the graving dock.

1.2.1.5 Graving Dock

- The graving dock has been designed to facilitate removal of fishes that become trapped in the lower channel when the gate is closed. Design features include:

    - A 3-foot deep by 2-foot wide channel around the perimeter of the lower chamber to concentrate the trapped fishes and facilitate removal;

    - The perimeter channels are connected to two, 8-foot long by 4-foot wide by 3-foot deep sumps. Each sump is lined with a removable steel box into which the trapped fishes will be herded. The boxes are designed to be lifted, by crane, into the harbor to release the fishes. Each box will have a removable, screened cover to prevent the fishes from jumping out while the box is lifted, and an aeration system to maintain sufficient oxygen levels.

    - Sloping the floor, where possible, to guide the fishes into the channel during dewatering.

- The pump intakes for the graving dock will be screened according to NOAA Fisheries' screening criteria.

- WSDOT shall develop a plan to minimize the number of fishes trapped in the graving dock when the gate is closed, and for minimizing the minimizing the likelihood of take associated with removing those that are trapped. The plan will be reviewed and approved by NOAA Fisheries prior to the first opening of the gate. Preliminary plans include the following measures:

- Prior to closing the gate, a seine will be pulled through the lower level to herd fish into the harbor.

- The entire graving dock shall be seined toward the fish collection sump(s) when the water within the graving facility is no less than 24 inches deep. Seine mesh size shall not exceed 0.25 inch.

- Larger fish shall be removed first in order to avoid battering of juvenile fish.

1.2.1.6 Temporary Overwater Structures

- All nighttime lighting will be kept to the minimum that is necessary for the intended purpose, in terms of both the intensity and area illuminated. Lights shall be directed on to the work area and away from the water.

- The temporary work bridge shall be equipped with under-pier lighting, using either reflected natural light or artificial light, designed and operated to mimic natural length in sufficient intensity to prevent hard shadows or excessively dark conditions that would be expected to deter juvenile salmonid migration under the pier. If artificial lights are used, they shall be equipped with an automatic system to replicate daily dawn to dusk light levels. Monitoring of light levels will be conducted. See monitoring plan in Appendix E.

- No portion of any pontoon, barge, or float system shall ground to avoid impacts to eel grass and forage fish spawning areas.

1.2.1.7 Habitat Restoration Activities

- All work will be done when the area is exposed by low tides.

1.3 Description of the Action Areas

The Action Area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR part 402.02). The action area for this project is divided into four sections: HC for the bridge and POFs; Port Angeles for the graving dock construction and operation; pontoon and anchor moorage in Port Angeles, Elliott

Bay and Commencement Bay; and the barge lanes for transporting the pontoons and anchors. Based on the expected noise levels resulting from the pile driving activities, descriptions of past graving dock operations, and methods of pontoon and anchor construction, the area of impact is estimated to include waters, shorelines, and riparian areas within a one-mile radius around all project features, and the barge lane between the sites, which will be addressed as a linear path between each of the sites.

1.3.1 Hood Canal Bridge and Passenger Only Ferry Activities

The HC action area includes the waters, shorelines and riparian areas along the canal from a one-mile radius around the Port Gamble POF terminal, south to a one-mile radius around the South Point POF terminal. This action area includes the bridge, POF terminals and the ferry route between the terminals. The primary aquatic effects will be shading by overwater structures, turbidity from construction activities, and potential impacts to fish from pile driving, and are not expected to extend beyond the one-mile radius.

1.3.2 Graving Dock

The graving dock will be constructed and operated at Port Angeles, Washington. The graving dock site is on 27 acres of industrial waterfront at the base of Ediz Hook, in the Port of Port Angeles. Based on ambient noise levels of the Port, current operations, methods of graving dock construction, methods of pontoon and anchor fabrication, and the hydraulic function of Port Angeles Harbor, the action area is estimated to include waters, shorelines and riparian areas within a mile radius of the graving dock facility.

1.3.3 Pontoon and Anchor Moorage

There are three sites that have been identified to meet the requirements for a moorage facility, Port of Port Angeles, Port of Seattle, and Port of Tacoma. The project contractor will determine the exact location of pontoon moorage, unless WSDOT obtains a specific site. All three ports are included in the action area. Based on activities which may be associated with the potential construction of a moorage dock such as pile driving and impacts associated with shading in shallow marine habitats, and the uncertainty of where in the ports this activity may occur, the action area will encompass all waters, shorelines and riparian areas within the port areas. Port Angeles appears to be the most promising site. The Rayonier Waterfront site is being investigated for potential moorage along the waterfront.

1.3.4 Barge Lanes

The barge lane is included in the action area due to the boat traffic associated with the transport of equipment to and from the bridge, ferry terminals, graving dock facility, moorage sites, and the transport of the pontoons and anchors. Tugs may also be used to transport construction materials and equipment such as cranes, piles, sheet piles, gravel and other materials. The anchors will be transported individually and the pontoons may be transported individually or in sets of three. Tugboats will make approximately 35 round trips from the graving dock to one of the three potential moorage sites, Port Angeles Harbor, Elliott Bay in Seattle, or Commencement Bay in Tacoma. If Port Angeles Harbor is chosen travel is limited to less than two miles to any potential moorage site. Elliott Bay is 69 nautical miles from Port Angeles, Commencement Bay is 89 nautical miles.

2.0 ENDANGERED SPECIES ACT

2.1 Biological Opinion

The purpose of consultation under the ESA is to ensure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of threatened or endangered species. Formal consultation concludes with the issuance of a Opinion under section 7(b)(3) of the ESA.

2.1.1 Status of the Species

2.1.1.1 Puget Sound Chinook

Puget Sound chinook salmon were listed as threatened under the ESA on March 24, 1999 (64 FR 14308). The ESU includes all naturally spawned populations of chinook salmon from rivers and streams flowing into the PS. This area also includes the Straits of Juan de Fuca from the Elwha River, eastward, including rivers and streams flowing into HC, South Sound, North Sound, and the Strait of Georgia in Washington State. The species status review identified the high level of hatchery production which masks severe population depression in the ESU, as well as severe degradation of spawning and rearing habitats, and restriction or elimination of migratory access as causes for the range-wide decline in PS chinook salmon stocks (NOAA Fisheries 1998a; 1998b). Critical habitat designation is not in effect for PS chinook.

The PS chinook salmon Evolutionarily Significant Unit (ESU) is likely to be adversely affected by the proposed action. For the purposes of conservation under the Act, an ESU is a distinct population segment that is substantially isolated, reproductively, from other conspecific population units and represents an important component in the evolutionary legacy of the species (Waples 1991).

Chinook salmon are the largest of the Pacific salmon (Netboy 1958), and exhibit the most diverse and complex life history strategies of all salmonids. Healey (1986) described 16 age categories for chinook salmon, seven total ages with three possible freshwater ages. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon that reside in freshwater for a year or more following emergence; and "ocean-type" chinook salmon that migrate to the ocean within their first year. Healey (1983; 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations. The generalized life history of chinook salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean.

The PS ESU consists of 31 historically quasi-independent populations of chinook salmon, of which 22 are believed to be extant (PSTRT 2001 and 2002). The populations that are presumed to be extirpated were mostly of early-returning fish, and most of these were in the mid- to southern parts of PS, HC and the Strait of Juan de Fuca. This ESU encompasses all runs of chinook salmon in the PS region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Chinook salmon are found in most of the rivers in this region. The boundaries of the PS ESU correspond generally with the boundaries of the Puget Lowland Ecoregion. Despite being in the rainshadow of the Olympic Mountains, the river systems in this area maintain high flow rates due to the melting snowpack in the surrounding mountains. Temperatures tend to be moderated by the marine environment.

Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run chinook salmon populations in the PS ESU have a high proportion of yearling smolt emigrants, the proportion varies from year to year and appears to be environmentally mediated rather than genetically determined. PS stocks all tend to mature at ages three and four and exhibit similar, coastally-oriented, ocean migration patterns.

The most recent five-year geometric mean natural spawner numbers in populations of PS chinook ranges from 42 to just over 7,000 fish. Most populations contain natural spawners numbering in the hundreds (median recent natural escapement = 481); and of the six populations with greater than 1,000 natural spawners, only two are thought to have a low fraction of hatchery fish. Estimates of historical equilibrium abundance from predicted pre-European settlement habitat conditions range from 1,700 to 51,000 potential chinook spawners per population. The historical estimates of spawner capacity are several orders of magnitude higher than realized spawner abundances currently observed throughout the ESU.

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Long-term trends in abundance and median population growth rates for naturally spawning populations of chinook in PS both indicate that approximately half of the populations are declining and half are increasing in abundance over the length of available time series. The number of populations with declining abundance over the short term (8 of 22 populations) is similar to long-term trends (12 of 22 populations).

Anthropogenic activities have blocked or reduced access to historical spawning grounds and altered downstream flow and thermal conditions. In general, upper tributaries have been impacted by forest practices while lower tributaries and mainstem rivers have been impacted by agriculture and/or urbanization. Diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation due to forest practices and urban development are cited as problems throughout the ESU (WDF, *et al.* 1993). Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in several basins. Bishop and Morgan (1996) identified a variety of habitat issues for streams in the range of this ESU including: (1) changes in flow regime (all basins); (2) sedimentation (all basins); (3) high temperatures in some stream; (4) streambed instability; (5) estuarine loss; (6) loss of LWD in some streams; (7) loss of pool habitat in some streams; (8) blockage or passage problems associated with dams or other structures; and (9) decreased gravel recruitment and loss of estuary areas. These impacts on the spawning and rearing environment may also have had an impact on the expression of many life-history traits and masked or exaggerated the distinctiveness of many stocks. The PS Salmon Stock Review Group (PFMC 1997) concluded that reductions in habitat capacity and quality have contributed to escapement problems for PS chinook salmon. It cited evidence of direct losses of tributary and mainstem habitat due to: (1) dams; (2) loss of slough and side-channel habitat caused by diking, dredging, and hydromodification; and (3) reductions in habitat quality due to land management activities.

The artificial propagation of fall-run stocks is widespread throughout this region. Summer/fall chinook salmon transfers between watersheds within and outside the region have been commonplace throughout this century; thus, the purity of naturally spawning stocks varies from river to river. Nearly two billion chinook salmon have been released into PS tributaries since the 1950s. The vast majority of these have been derived from local returning fall-run adults. Returns to hatcheries have accounted for 57% of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher than that due to hatchery-derived strays on the spawning grounds. The electrophoretic similarity between Green River fall-run chinook salmon and several other fall-run stocks in PS (Marshall*, et al.* 1995) suggests that there may have been a significant and lasting effect from some hatchery transplants. Overall, the pervasive use of Green River stock throughout much of the extensive hatchery network, in this ESU, may reduce the genetic diversity and fitness of naturally spawning populations.

Harvest impacts on PS chinook salmon populations averaged 75% (median=85%; range 31-92%) in the earliest five years of data availability and have dropped to an average of 44% (median=45%; range 26-63%) in the most recent five-year period.

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high. Both long- and short-term trends in abundance are predominantly downward, and several populations are exhibiting severe short-term declines. Spring-run chinook salmon populations throughout this ESU are all depressed.

Other concerns noted by the Biological Review Team (BRT) are the concentration of the majority of natural production in just two basins, high levels of hatchery production in many areas of the ESU, and widespread loss of estuary and lower floodplain habitat diversity and, likely, associated life history types. Populations in this ESU have not experienced the sharp increases in the late 1990's seen in many other ESUs, more populations have increased than decreased since the last BRT assessment. After adjusting for changes in harvest rates, however, trends in productivity are less favorable. Most populations are relatively small, and recent abundance within the ESU is only a small fraction of estimated historic run size.

2.1.1.2 Hood Canal Summer-Run Chum

Hood Canal Summer-run chum salmon were listed as threatened on March 24, 1999 (64 FR 14508). Threats to the continued existence of these populations include degradation of spawning habitat, low water flows, and incidental harvest in salmon fisheries in the Strait of Juan De Fuca and coho salmon fisheries in HC (Johnson*, et al.* 1997). This ESU contains summer-run chum populations in HC and in Discovery and Sequim Bays on the Strait of Juan De Fuca. Distinctive life history and genetic traits were the most important factors in identifying this ESU.

Chum salmon are semelparous; they spawn primarily in freshwater, and apparently exhibit obligatory anadromy, as there are no recorded landlocked or naturalized freshwater populations (Randall*, et al.* 1987).

The species has the widest natural geographic and spawning distribution of any Pacific salmonid. Presently, major spawning populations in the eastern north Pacific Ocean are found only as far south as Tillamook Bay on the Northern Oregon coast. Chum salmon may historically have been the most abundant of all salmonids. Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean. Chum salmon also grow to be among the largest of Pacific salmon, second only to chinook salmon in adult size. Average size for the species is around 3.6 to 6.8 kg (Salo 1991).

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum salmon usually spawn in coastal areas and juveniles out migrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). Thus the nearshore (and intertidal) areas within the geographic region of the ESU are especially important to outmigrant juveniles (Simenstad, *et al.* 1985; Simenstad 2000; Hirschi, *et al.* 2003). This means survival and growth in juvenile chum salmon depends on favorable estuarine conditions. Another unique behavior of chum salmon (relative to other species of salmonids) is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

In December 1997, the first ESA status review of west coast chum salmon (Johnson *et al.* 1997) was published. In January 2003, NOAA's National Marine Fisheries Service (NOAA Fisheries) convened a BRT to update the status of listed chum salmon. The chum salmon BRT met in Seattle, Washington, to review recent information on the HCSR chum salmon ESU, among other chum salmon ESUs.

This ESU includes summer-run chum salmon populations in HC and in streams of Discovery and Sequim bays on the Strait of Juan de Fuca. It may also include summer-run chum salmon in the Dungeness River, but the existence of that run is uncertain. Distinctive life-history and genetic traits were the most important factors in identifying this ESU. The HCSR chum ESU consists of 16 historically quasi-independent populations, nine of which are presumed to be extirpated.

Most of the extirpated populations occur on the eastern side of HC, and some of the putatively extinct stocks are the focus of extensive supplementation programs underway in the ESU (WDFW and PNPTT 2000 and 2001).

Between 1975 and 1991, an average of 8.1 million chum salmon per year were released from hatcheries in HC before the end of March. A consequence of these earlier timed releases is that the separation in outmigration timing between summer and fall chum has been lessened. Beginning in 1992 the Hood Canal summer chum salmon became part of an extensive rebuilding program (WDFW and PNPTT 2000 and 2001). This program involves six supplementation and two reintroduction projects. Small numbers of marked fish collected in streams (greater than or equal to 3 per stream) over the 1999-2000 season indicate that straying of summer chum is occurring into non-target streams (WDFW and PNPTT 2001).

Recent geometric mean abundance of summer chum in HC streams ranges from one to almost 4,500 spawners (median = 109, mean = 542). Estimates for the fraction of hatchery fish in some stream populations are greater than 60%, indicating that the reintroduction program through hatchery supplementation is resulting in spawners in streams.

Long-term trends in abundance and median population growth rates for naturally spawning populations of summer chum in HC both indicate that the number of populations with declining abundance over the short-term is fewer than those with declining long-term trends. Only two stream populations are increasing in abundance over the length of available time series and this is almost surely due to the supplementation program on that stream. The median long-term population growth rates over all populations was l = 0.88 (regardless of assumptions about hatchery fish reproduction), indicating that most populations are declining at an average rate of 12% per year.

A variety of threats to the continued existence of the summer chum populations in HC were identified, including degradation of spawning habitat, widespread loss of estuary and lower flood-plain habitat, low river flows, possible competition among hatchery fall chum salmon juveniles and naturally produced summer chum salmon juveniles in HC, and high levels of incidental harvest in salmon fisheries in HC and the Strait of Juan de Fuca. Additional threats to the continued existence of the summer chum populations in HC were identified in the first status review (Myers, *et al.* 1996), including the increasing urbanization of the Kitsap Peninsula, recent increases in pinniped populations in HC, and the fact that recent increases in spawning escapement have been associated primarily with hatchery supplementation programs. Concerns were mitigated to some extent by recent reforms in hatchery practices for fall chum salmon and measures to reduce harvest impacts on summer chum salmon.

Harvest rates on Hood Canal summer chum populations averaged 9.6% (median = 9.6%; range 7.2%-11.8%) in the earliest five years of data availability and have dropped to an average of 5% (median = 3.5; range 0.2%-14.4%) in the most recent 5-year period.

Few of the streams in HC containing summer chum populations have data on returns of hatchery adults to the stream. The marking of hatchery-origin fish has recently begun.

Additional threats to HC summer chum salmon include negative interactions with hatchery fish (fall chinook, coho, pink, and fall chum salmon) through predation, competition and behavior modification, or disease transfer. Specific mitigation measures have been identified for those hatchery programs deemed to pose a risk to summer chum, and most of the mitigation measures had been implemented by 2000. In addition, some programs have been discontinued.

Long-term climatic changes, such as the Aleutian Low Pressure Index (ALP), Pacific Interdecadal Oscillation (PDO) Index or the Cold Tongue (CT) Index (Beamish and Bouillon 1993; Hare and Francis 1995) may be a factor in the variability of survival of Hood Canal summer chum salmon. These oscillating "warm" and "cool" regimes occur on decadal scales.

Predation on summer chum by marine mammals in HC has been monitored by WDFW since 1998. The most recent results from these studies estimate that a few harbor seals are killing hundreds of summer chum each year (WDFW and PNPTT 2001). Estimates of seal predation ranged from 2% to 29% of the summer chum returning to each river annually.

New activities related to mitigating and improving degraded habitat quality in HC are reported (WDFW and PNPTT 2001). Such activities include new shoreline management rules issued by WDOE (but no resulting change in shoreline master programs yet), Jefferson County improved some development codes under the Growth Management Act, Clallam County provided limited improvements in upgrading its Critical Areas Ordinance in 1999, and several habitat improvement projects have been funded by the Washington State Salmon Recovery Funding Board.

A majority of the BRT votes fell in the “likely to become endangered,” or “danger of extinction” categories, with a minority falling in the “not likely to become endangered” category. The BRT has ongoing concerns for the major risk factors identified in previous assessments.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species. This analysis involves the initial steps of: (1) defining the biological requirements and current status of the listed species; and (2) evaluating the relevance of the environmental baseline to the species’ current status.

NOAA Fisheries is required to evaluate whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of injury and mortality attributable to: (1) collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species’ life stages that occur beyond the action area. A finding of jeopardy is appropriate if the action, together with the baseline conditions and cumulative effects, appreciably reduces the species’ likelihood of survival or recovery by reducing the numbers, distribution, or reproduction of the species. If

NOAA Fisheries finds that the action is likely to jeopardize PS chinook and/or HCSR chum, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

For this specific action, NOAA Fisheries' analysis considers the extent to which the proposed action impairs the function of habitat elements necessary for rearing, and migration of PS chinook salmon and/or HCSR chum. The HC is a major migratory pathway for PS chinook and HCSR chum that originate in systems that flow into the canal. Port Angeles is located along the migratory pathway for most PS chinook, and for all HCSR chum. Elliott Bay is along the major migratory pathway for chinook salmon from the Green/Duwamish Basin, as well as for those salmon originating in South PS. Commencement Bay is along the major migratory pathway for PS chinook originating in the Puyallup River and those rivers to the south in PS.

2.1.2.1 Biological Requirements

The first step NOAA Fisheries uses when conducting the ESA section 7(a)(2) analysis is to define the species' biological requirements within the action area. NOAA Fisheries then considers the current status of the listed species taking into account species information, *e.g.,* population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list these species for ESA protection within the ESUs considered in this Opinion and also considers any new data that are relevant to the determination.

Biological requirements are those conditions necessary for the PS chinook and HCSR chum salmon ESUs to survive and recover to naturally reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stocks, enhance the species' capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. Specific information related to biological requirements for PS chinook salmon can be found in Myers, *et al.* (1998), and for HCSR chum in Johnson, *et al.* (1997).

Biological requirements are generally defined as properly functioning habitat relevant to each life history stage. In addition, there must be enough of the properly functioning habitat to ensure the continued existence and recovery of the ESU. The biological requirements for PS chinook salmon and HCSR chum in the marine environment include adequate food (energy) sources, high water quality, sufficient habitat structures, favorable passage conditions (migratory access to and from potential spawning and rearing areas), and appropriate biotic interactions (Spence, *et al.* 1996). The specific biological requirements for PS chinook and HCSR chum that are influenced by the action considered in this Opinion include food, water quality, habitat structure, and biotic interactions. Presently, due to degraded conditions described in the following subsection, the biological requirements of PS chinook and HCSR chum salmon are not being met under the environmental baseline. The specific habitats that are likely to be affected by the project are nearshore and intertidal areas in marine waters that are necessary for juvenile chinook and chum rearing and migration.

2.1.2.3 Status of the Species in the Action Area

2.1.2.3.1 Status of Puget Sound Chinook in the Action Area

Puget Sound chinook are found throughout the action area. While no spawning occurs in the action area, it is utilized by PS chinook during all marine life-history stages. Upon entering the marine environment, the juveniles are obligate inhabitants of the shallow, nearshore waters of the action area, where they forage and migrate away from their natal streams. When they grow to a sufficient size, the juveniles are able to move between the nearshore habitat and deeper waters. Some of these fish will migrate to the ocean, while others will reside in the waters of PS and HC throughout their marine phase (Graeber, pers. comm. 2003).

Hood Canal

Spring, summer, and fall runs of chinook salmon in the rivers associated with HC, with the fall run fish predominating. All of these runs exhibit an ocean-type life history (63 FR 11481). Ocean-type fish tend to mature in coastal waters rather than going far out to sea. A portion of these fish reside in the waters of HC throughout their marine phase and never enter the ocean (Graeber, pers. comm. 2003). These fish migrate up the rivers to spawn from late July through October (WDF, *et al.* 1993). The runs include hatchery and native fish. These adults may enter the HC months before they head up the rivers.

Adults and juvenile chinook salmon use the waters near the bridge, Port Gamble and South Point for transport during migration. The nearest stream to Port Gamble (17.46 miles) and South Point (12.9) is Big Beef Creek. The smaller, nearshore-bound juvenile chinook will most likely be moving through the waters near the bridge, Port Gamble, and South Point from May until August, while later life history stages are likely to be present throughout the year (WSDOT 2003; Graeber, pers. comm. 2003).

Port Angeles

Virtually no data are available on the utilization of the harbor at Port Angeles by PS chinook. However, many of the outmigrants from PS and HC are expected to pass through the nearshore waters of Port Angeles. The rivers and creeks nearest the graving dock site in Port Angeles that support populations of PS chinook are the Elwha River, the Dungeness River, and Morse Creek. The Dungeness River is located approximately 15 miles east of the site. There is a spring/summer-run of chinook with a 5-year mean escapement of only 105 fish (Myers, *et al.* 1998). In 1999, the total escapement was only 75 chinook (Marlowe, *et al.* 2001). Due to the dire conditions of the Dungeness population, a captive broodstock program was initiated in 1992. Hatchery releases of juvenile chinook for 2003 are expected to peak in May and June, but operation of the hatchery beyond 2004 is in question (Rapelje, pers. comm. 2003). Marlow, *et al.* (2001) collected wild chinook in smolt traps from early June through mid-September. Since wild chinook were captured at the beginning and end of the study, it is likely that the earliest and latest fish were missed. Considering both hatchery and wild fish, Dungeness chinook may be present in the action area from May through mid-September and beyond. The

Dungeness spring/summer populations begin spawning in mid-August and continue through mid-October.

Morse Creek drains into the Strait of Juan de Fuca several miles to the east of the site and has a severely depressed (around 10 or less last year) population of chinook which may consist of hatchery strays (WSDOT 2003). The Elwha River enters the straits just west of Port Angeles and has a mean natural escapement of 1,800 fish (Myers, *et al.* 1998). The Morse Creek and Elwha summer/fall populations begin spawning in late August and continue into early October (WDF, *et al.* 1994).

Elliott Bay/Duwamish River

PS chinook occurring in Elliott Bay are from two primary sources: the Duwamish River estuary and rivers that flow into PS to the south of Elliott Bay. However, chinook from almost any river in the PS basin may be found in Elliott Bay (Graeber, pers. comm. 2003). Chinook salmon migrating through the Duwamish River estuary are divided into two main stocks: the Duwamish/Green River summer/fall stock and the Duwamish/Green River-Newaukum Creek summer/fall stock (WDFW 1994). Spring chinook were historically present in the Green/Duwamish River basin. However, returns from this run are in such low numbers that they are difficult to detect. It is possible that the spring run became extirpated by the original construction effects of the Tacoma Headworks Dam in 1911, or became isolated from the basin by the diversion of the White River in 1906 (Kerwin and Nelson 2000).

Green/Duwamish summer/fall chinook salmon remain relatively abundant because of hatchery production. Although the Washington State Salmon and Steelhead Stock Inventory (WDFW 1994) rated the Green/Duwamish summer/fall chinook as "healthy," the overall trend in abundance of PS chinook is predominantly downward. Stream spawning escapement estimates which includes hatchery strays can lead to significant overestimation of the natural chinook run. The confounding effect of hatchery strays on wild chinook production in systems such as the Green/Duwamish River was identified in the NOAA Fisheries status review as a key concern leading to the listing of chinook salmon (Myers, *et al.* 1998)

Summer/fall chinook salmon in the Duwamish/Green system are ocean-type fish that rear in freshwater for a few months after emerging from the gravel before migrating to the ocean in the spring as sub-yearling smolts. Juveniles are abundant in the mainstem of the Green River from March through April and occur in the Lower Duwamish Waterway from early March through late July (Meyer, *et al.* 1981; Low and Myers 2002). Other studies have found juvenile chinook salmon in the Duwamish as early as mid February (K. Fresh pers. comm. 2003). Although juvenile chinook are present in the Lower Duwamish Waterway over an 8-month period, catch data show an abrupt increase in smolts in mid-May followed by an equally abrupt decrease. This indicates that most of the fish represented in the pulse of abundance were not in the Lower Duwamish Waterway for more than two weeks (Warner and Fritz 1995).

Similar to timing of juvenile chinook emigration peaks in the Duwamish estuary, increasing abundances of juvenile chinook have been observed in Elliot Bay, but only through the summer months. Taylor, *et al.* (1999) found the greatest numbers of juvenile chinook at Terminal 5, located immediately west of Harbor Island, in mid-May, and at Pier 91, located four miles north of the Duwamish, in early June. Beamish, *et al.* (1998) sampled salmonids throughout PS and observed that some juvenile chinook salmon remain in PS through fall and winter (Starkes 2001).

Th.e summer/fall stock migrate upstream through the Lower Duwamish Waterway to spawning grounds from late June into early November, with large numbers entering the river by July (Williams, *et al.* 1975; Frissell, *et al.* 2000; Kerwin and Nelson 2000). Adults primarily spawn between mid-September and October (WDFW 1994; Williams, *et al.* 1975). No chinook salmon spawning is known to occur in the Lower Duwamish Waterway or in the smaller streams flowing into the estuary and lower reaches of the waterway (Weitkamp and Ruggerone 2000).

Commencement Bay

PS chinook in Commencement Bay originate from two primary sources: the Puyallup River and the rivers that enter PS to the south of Commencement Bay. However, chinook form almost any river in the PS basin may occur in Commencement Bay (Graeber, pers. comm. 2003). Juvenile chinook, migrating through the Puyallup River delta and Commencement Bay originate from three basic stocks (SASSI 1992): White (Puyallup) River spring; White River summer/fall; and Puyallup River fall. These fish consist of an unknown mixture of natural and hatchery origin fish.

Artificial propagation programs likely provide most of the numbers of chinook in the Puyallup River. The White River spring chinook population which is considered critical by state and tribal fisheries managers depends largely on artificial production (SASSI 1992). The White River spring chinook have lately experienced a tenuous rebound as escapement gradually has increased from the historic lows of the 1980s. In 2000, non-tagged returns of adults was 1,732 individuals, the largest return in 30 years. This increase is consistent with larger numbers of chinook in the Columbia River during 2000, indicating good ocean survival (NOAA Fisheries 2001a).

The White River summer/fall chinook stock is considered wild and classified by the co-managers as distinct based on geographic distribution. The glacial melt waters, typical of the Puyallup River, cause poor visibility during spawning season. Due to this, the stock status is unknown (SASSI 1992).

Numbers of Puyallup fall chinook have recently been compiled by the Puyallup Tribe of Indians for the Washington State Shared Strategy indicating the current number of spawners at 2,400. The Washington Shared Strategy is a voluntary and collaborative effort that is developing goals for recovery planning ranges and targets building on existing efforts of local governments, watershed groups, and various state, Federal, and tribal entities to produce a viable recovery plan. Targets relating the quality and capacity of chinook habitat to population response associated with recovered habitat indicated a range of 5,300 to 18,000 spawners necessary for a recovered system (Puyallup Tribe 2002).

Field observations of PS chinook in the action area revealed that habitat use differed between the mouth and the head of waterways and also between the locations of the waterways in relation to the Puyallup River. The Puyallup Tribe of Indians conducted beach seine sampling between the years 1980 -1995 (however, no data were available in 1988, 1989, and 1990). Duker *et al.* (1989) conducted an extensive beach seine juvenile sampling effort in 1983 at many of the beach seine sampling location as the tribe's efforts plus tow net sampling to investigate distribution in the open water habitats of Commencement Bay. In addition, sampling of salmonid distribution has been conducted at a number of sites during a course of impact assessment and/or mitigation site planning. Some general conclusions from these studies indicated that: juvenile chinook are present in low numbers in March; peak in late May or early June and drop to low numbers again by July 1; the progeny of naturally spawned chinook arrive in the estuary throughout this period at a variety of lengths; offshore catches of chinook peak about two weeks later than shoreline catches; and all shorelines are used but catches are typically higher near the mouths of the waterways than near the heads (Kerwin 1999). Hooper (NOAA Fisheries 2001a) compiled catch per unit effort of chinook salmon at sites close to and further away from the Puyallup River. This data found that the catch per unit effort averaged 20.4 in the Milwaukee Waterway, 2.93 in the Blair Waterway and 1.99 in the Hylebos Waterway. The catch per unit was higher in the waterways closest to the river.

2.1.2.3.2 Status of Hood Canal Summer-Run Chum in the Action Area

In the action area, HCSR chum are found only in HC and Port Angeles. While no spawning occurs in the action area, it is utilized by HCSR chum during the migratory phases of the marine life-history stages. Upon entering the marine environment, the juveniles are obligate inhabitants of the shallow, nearshore waters of the action area, where they forage and migrate away from their natal streams (Bax, *et al.* 1979). "Early run" chum fry in HC (defined as chum juveniles migrating during February and March) usually occupy sublittoral seagrass beds with residence time of about one week (Wissmar and Simenstad 1980). Schreiner (1977) reported that HC chum maintained a nearshore distribution until they reached a size of 45-50 milllimeters, at which time they moved to deeper off-shore areas. Mature adults, returning to their natal streams to spawn, pass through the action area.

Hood Canal

Hood Canal Summer-run chum that occur in the vicinity of the bridge and POF terminals originate in streams flowing into HC to the south. Streams to the south that still produce summer-run chum are the Rivers. Escapements in the Big and Little Quilcene Rivers has increased in recent years due to a supplementation program begun in 1992 (WDFW and PNPTT 2000). The Dosewallips and Duckabush have had escapement above levels of concern, while escapements in the Hamma Hamma and, particularly, the Lilliwaup have been below threshold levels for sustaining the stocks. Due to the low escapement in the Hamma Hamma and Lilliwaup, supplementation programs were implemented in 1992, but have been hampered by an inability to collect sufficient broodstock (WDFW and PNPTT 2000). Six stocks from south of the action area are considered to be extirpated or "functionally extinct": the Skykomish, Finch

Creek, Anderson Creek, Dewatto, Tahuya and Big Beef Creek (Tynan 1997). A re-introduction program has been implemented for Big Beef Creek using the Quilcene stock.

Juvenile chum salmon migrate through these waters from late February to late July, peaking in May and June (Bax, *et al.* 1980; Bax 1983a; 1983b). However, run timing is dependent upon whether the chum salmon are of hatchery or wild origin. Tynan (1997) estimated that wild HCSR chum will be present in the action area from mid-February through early May, with peak abundances estimated to occur in early April. Chum fry arriving in the HC estuary are initially widely dispersed (Bax 1982), but form loose aggregations oriented to the shoreline within a few days (Schreiner 1977; Bax 1983b). These aggregations occur in daylight hours only, and tend to break up after dark (Feller 1974), regrouping nearshore at dawn the following morning (Schreiner 1977; Bax 1983).

Returning summer-run chum enter the HC terminal area from early August through the end of September (WDF, *et al.* 1994). Entry pattern data for Quilcene Bay provided by Lampsakis (1994) suggest that summer chum enter extreme terminal marine areas adjacent to natal streams from the third week in August, through the first week in October, with a central 80% run timing of August 30 through September 28, and a peak on September 16.

Port Angeles

In the Strait of Juan de Fuca, summer chum stocks are found in Snow, Salmon, and Jimmycomelately creeks and the Dungeness River (Snow and Salmon are treated as a single stock complex). The terminal abundance of summer chum in the Strait of Juan de Fuca region began to decline in 1989, a decade after the decline observed for summer chum in HC. Terminal abundance declined from an average of 1,923 for the 1974 to 1988 period to an average of 477 during 1989 to 1994 period. During the most recent period (1995 to 1998) the average for the region has increased to 1,039, however, much of the increase may be due to the supplementation program in the Snow/Salmon system that was initiated in 1992. Escapement in Jimmycomelately Creek has been 61 spawners or less during three of the last five years (Bernthal 1999). There are no systematic surveys for summer chum in the Dungeness. However, their presence is routinely noted in surveys for other species. There may exist a small self-sustaining population. The status of the summer chum population in the Dungeness is therefore unknown.

Hood Canal Summer-run chum from the Strait of Juan deFuca generally emerge later than those from HC due to colder stream incubation temperatures. Estimated, average 10%, 50%, and 90% emergence dates for Strait of Juan de Fuca summer chum are March 6, April 4, and April 26, respectively. The 10% to 90% emergence range estimated across years for Strait chum is February 15 through May 26 (Tynan 1997).

Strait of Juan de Fuca summer chum begin spawning during the first week of September, reaching completion in mid-October (WDF, *et al.* 1994). Time density analysis of Snow, Salmon and Jimmycomelately Creek spawner survey data for the lower portions of the drainages indicates a central 80% spawning ground timing of September 16 through October 20, with an average peak on October 2 (Lampsakis 1994).

2.1.2.4 Envrionmental Baseline

The environmental baseline represents the current conditions to which the effects of the proposed action would be added. The term "environmental baseline" means "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02).

2.1.2.4.1 Hood Canal

The following baseline description covers the action area in HC, and includes the bridge site and the POF terminal sites at Port Gamble and South Point.

Hood Canal is a large fjord that is separated from PS by the Kitsap Peninsula. Hood Canal averages 3.8-miles wide and 500-feet deep, with a maximum width 10.2 miles and maximum depth of 600 feet (Johnson, *et al.* 1997). The canal stretches 63 miles from its mouth at Admiralty Inlet to the tip of Lynch Cove at Belfair. At the southern extent of HC, where the Skokomish River enters the HC, a 90-degree bend to the east occurs (The Great Bend).

Four WRIAs drain into HC: Kennedy-Goldbsorough (WRIA 14); Kitsap Basin (WRIA 15); HC Basin (WRIA 16); and Quilcene Basin (WRIA 17). Hood Canal has several major tributaries including the Skokomish, Big Quilcene, Dosewallips, Duckabush, Dewatto, Hamma Hamma, and Union rivers. WRIAs 15 and 17 encompass the HC Bridge.

The immediate shores of HC in the bridge vicinity lack wetland habitats or overhanging vegetation. The eastern shore consists of gravel and driftwood. Scattered red alder saplings and pockets of grass are present directly inshore of the driftwood line. Low shrubs and 80-foot conifer trees form the boundary between the beach and the mown lawns of the adjacent residences. The western shore consists of large gravel and riprap used to protect the road accessing the state park. An estuarine wetland exists on the west side of the state park road.

The Port Gamble Ferry Terminal is developed for industrial uses, has virtually no ground cover and is paved. The South Point Ferry Terminal site has limited vegetation and is paved although upland habitats are forested. The Fred Hill Park and Ride site is developed for industrial uses, has virtually no ground cover and is covered with gravel.

Land use in the action area consists primarily of recreational activities, rural residential, and commercial traffic in and around the waters of HC. The west bank of the canal is steeply sloped and lacks residential development directly south of the bridge. Shine Tidelands State Park is located directly north of the bridge on the west bank. The east bank of the canal north and south of the bridge is considered to be rural residential. Salsbury Point County Park is located on the east bank, approximately one-quarter mile north of the bridge. Commercial activities are limited to commercial and freight trucks and vessels traveling through the action area.

Recreational boating activities, including fishing are common in the Canal. Public boat launches are located on both the east and the west banks just north of the bridge. The local fishery includes sport and tribal fishing. No commercial fishing occurs in the HC. The abundance of boats on the water is seasonal and varies with the length of the sport fishing season set by WDFW. U.S. Navy ships, including Trident submarines, pass through the draw span regularly traveling to and from Bangor Naval Station. Bangor Naval Station is located approximately 10 miles south of the bridge. Commercial fishing and freight vessels also frequently pass through the span.

Disturbance in this portion of the action area consists primarily of car, logging truck, and boat traffic, industrial use and residential development. Noise levels are generally high due to bridge traffic, activities associated with operation of the log yard at Port Gamble. Average weekend (Friday to Sunday) traffic across the bridge is approximately 9,374 vehicles eastbound and 9,386 westbound (total 18,760) and decreasing to approximately 14,916 vehicles on weekdays (WSDOT 2000). U.S. Navy vessels, freight vessels and recreational boat traffic contribute to the high levels of noise. Recreational activities associated with both parks and the residential development on the east bank of HC contributes to the level of human disturbance within the area of the project.

Northern HC has 20 parameters listed on the WDOE's 303(d) List of Threatened and Endangered Waters (WDOE 2000) within WRIA 15, and three within WRIA 16. Water quality in HC is characterized by low dissolved oxygen (DO), high fecal coliform, and high levels of heavy metals and chemicals. Gamble Creek, which is a tributary to Port Gamble bay, is listed for fecal coliform, and Port Gamble is listed for PCBs and dieldrin and fecal coliform.

Hood Canal is a somewhat smaller, simplified version of PS proper, with a vigorous circulation. The overall circulation of HC is that the lower water column is flooding and the upper surface waters are ebbing. Intrusions of high-density water via Admiralty Inlet and several sources of fresh water produce strong near-surface stratification within the euphotic zone throughout much of the year. In bottom waters, the combination of organic matter decomposition and low oxygen trap and redistribute redox-sensitive constituents and trace constituents that exist in marine particulate organic matter.

Research is underway to better understand the causes of hypoxic (low DO) events in HC and to begin formulating control strategies. One potential contributor to these hypoxic events is the HC Bridge (Ebbesmeyer, pers. comm. 2002). As the upper layer ebbs, it impacts the south side of the bridge and is deflected downward, mixing with the deeper waters that are flooding into the canal. This surface layer carries a relatively high organic load, and some of that load is mixed into the deeper, low-organic waters. As this added organic material decomposes, it reduces the DO of the deeper waters. This low DO is most noticeable as seasonal hypoxic events near the Great Bend of the Canal, about 3.4 miles southward. Different bridge designs have been evaluated that would increase surface water outflow (*i.e.,* spaced pontoons with open spans between). However, due to the extreme weather conditions, and the length of the floating portion of the bridge (6,470 feet), the technology to accomplish this is not yet available. In the future when bridge replacement is required, the causes of the hypoxic/anoxic conditions will be better understood, and bridge construction technology may be available to address the situation.

The numerous private and commercial docks in the HC may create barriers along the shorelines to outmigrating juvenile PS chinook and HCSR chum. There has also been some speculation that the bridge itself is a partial barrier to many animal species, including salmon, migrating through HC. It is suspected that juvenile migrate along the bridge structure into deeper water and become susceptible to predation but no studies have been completed on the bridge to determine if it is a barrier. Shorelines in the HC action area are directly exposed to severe storms. Bulkheads have been constructed to protect property including the future ferry terminal location. Several structures have been built out into the bay and along with bulkheads are considered to deflect shoreward migrating juvenile salmonids to deeper water where predation is speculated to be higher (Kerwin 1999).

A survey of eelgrass and macroalgae was conducted in June of 1999 (Pentec 1999). The surveys were located approximately one-third mile north of the bridge. Macroalgae cover averaged 17% of the aquatic vegetation and consisted primarily of green algae (*Ulva* spp.) and brown algae (*Laminara* spp.) and eelgrass (Pentec 1999). Eelgrass, an important habitat for juvenile salmonids (Thom, *et al*. 1989; Williams, *et al.* 2001), is found in lush beds in HC and forms a contiguous band at lower intertidal elevations in the area of the bridge (Simenstad, *et al.* 2001) and South Point. Eelgrass is also an important spawning substrate for Pacific herring (*Clupea harengus*), and spawning has been documented in Port Gamble and near the bridge (WDFW http://www.wa.gov/wdfw/fish/forage/forage.htm).

The sand/gravel substratum exhibited within the project area of the bridge replacement is representative of the majority of HC. The substrate is primarily sand and fines less than .20 inches and some quantities of gravel .20 to 3.0 inches. The nearshore area is considered spawning habitat for sand lance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) (WDFW 1998), two important prey species for salmonids. Sand lance spawing has been documented at Port Gamble and South Point, while surf smelt spawning has been documented at Port Gamble and near the bridge. These species spawn in the upper intertidal zone of beaches. The shade cast by overhanging riparian vegetation is important for maintaining the cool temperatures needed by incubating surf smelt eggs, but destruction of this vegetation at Port Gamble has occurred due to past development activities (WSDOT 2003).

The sand/silt substratum is elevated in Port Gamble Bay from past log mill and logging practices within the watershed. These conditions drastically reduce light penetration and increase smothering of vegetative and benthic communities. As a result, foraging areas have been greatly reduced in the area (Kerwin 1999).

2.1.2.4.2 Port Angeles Harbor

The harbor at Port Angeles is formed and protected by Ediz Hook, a 3.5-mile long natural sand spit formed by the eastward movement of littoral sand, gravel and cobbles from eroding sea cliffs immediately to the west and from river borne sediments from the Elwha River. The harbor is the only deep-draft harbor on the northern shore of the Olympic Peninsula. Several small streams drain into the Harbor, including Tumwater, Valley, Peabody, Ennis and Lees Creeks. From Ediz Hook, the floor of the harbor slopes gently to the south and is relatively flat. Sediments above zero feet MLLW consist primarily of cobble and boulder and below are composed of a mix of sand and cobble. Sediments below -18 feet MLLW consist of silt with wood debris, including some logs (SAIC 1999).

According to the WRIA 18 Habitat Limiting Factors Report, estuarine and marine habitats in the harbor are degraded as a result of: (1) physical alteration of natural estuaries; (2) significant alteration of nearshore ecological function due to shoreline armoring; and (3) poor water quality. A recent report on the Harbor (Pentec 2001) cited wood debris accumulation, shoreline armoring and lack of riparian vegetation as factors leading to degraded nearshore habitats.

Land use in the vicinity of the graving dock and beach restoration sites is primarily industrial, with suburban residential areas on land surrounding the Port. Industrial properties to the east and west of the graving dock operate wood and pulp processing factories. At the landward end of Ediz Hook is a paper mill owned and operated by Daishowa America Company, Ltd. The mill also produces and exports wood chips. At the seaward end of Ediz Hook is the U.S. Coast Guard air-sea rescue station, with a 4,000-foot long runway.

The Port of Port Angeles is an active international port. Four unrestricted boat launches, an international ferry terminal, facilities for large ship maintenance, and traffic from cargo ships occur in the vicinity of the port. Five deepwater berths are present, all capable of handling vessels up to 1,200 feet in length. The depth at the berths can accommodate vessels with draft of up to 45 feet. Two of the deep-water terminals owned by the Port have the ability to accommodate a wide variety of vessels from barges to supertankers. The main cargo shipped from the Port’s Marine Terminals is forest products in the form of logs and lumber.

The international ferry terminal supports runs between Port Angeles and Vancouver Island, British Columbia which leave every 45 minutes from early morning to late evening. In addition, the Port-owned marina has moorage available for over 520 recreational and commercial boats.

Disturbance in the Port of Port Angeles action area primarily consists of noise generated by industrial equipment, trucks and vessels loading, unloading and transporting cargo, and car, truck, and boat traffic. Noise levels are generally high at the graving dock site due to heavy traffic volumes traveling to and from the Port, and the operation of log yards and pulp mills. Large commercial fishing and freight vessels also contribute to the high levels of noise in the project vicinity. Recreational activities including boating, fishing, and scuba diving also contribute, albeit to a lesser degree, to disturbance in the vicinity.

Port Angeles Harbor is classified as "Class A" marine waters. The waters and sediments of Port Angeles Harbor have been contaminated by decades of industrial activity, particularly pulp mills. Contaminants of concern include hydrocarbons, PCBs, lead and dioxins/furans. Wood waste covers approximately 25% of the bottom of the harbor, primarily in nearshore log-booming areas, including the immediate vicinity of the proposed graving dock (SAIC 1999). The pulp mills in the area discharged wastewater directly into the harbor until the 1970s, when primary and secondary treatment systems were established and discharges were routed through a deep-water outfall. The 75-acre Rayonier Mill was the largest in the area. It operated for 67 years prior to closing in 1967. The Rayonier site is currently the subject of a cleanup effort under the State of Washington's Model Toxics Control Act.

Recently, the Harbor was included on the Washington Department of Ecology's (WDOE 2000) 1998 Section 303(d) list of Candidate Impaired and Threatened Waterbodies for low DO. SAIC (1999) concluded that the low DO is due, at least in part, to the accumulated wood debris. However, the low DO may be natural events related to upwelling of colder, saline waters (Loehr 1994). In the past, sediment quality within the harbor has exceeded standards for one or more metals (PSWQA 1992).

A survey of macroinvertebrate abundance and diversity across the harbor was conducted in 1999 (SAIC 1999). The survey found the invertebrate infaunal community in most areas consists of small sediment surface feeding or filtering organisms and larger head-down deposit feeders. These invertebrate forms were combined in a community in most offshore areas of the harbor. The historic log-booming grounds, on the other hand, had mostly pioneering surface-feeding or filtering organisms, and a few sites at the west end of the harbor showed little evidence of benthic infaunal colonization.

Spawning by Pacific sand lance (*Ammodytes hexapterus*) has been documented in the harbor, primarily on the beaches along the inside edge of Ediz Hook (Burkle, pers. comm. 2003). Sand lance are an important prey species for PS chinook and HCSR chum.

2.1.2.4.3 Elliott Bay/Duwamish River

The status and condition of the habitat in Elliott Bay and east central PS is degraded. Most of the Seattle shoreline of Elliott Bay and east central PS is armored, generally with rock and riprap. The shoreline lacks natural, overhanging vegetation. Historically, overhanging vegetation was probably a major source of nutrients fueling the nearshore food web (Simenstad and Wissmar 1985). Shoreline armoring has stopped most of the erosion from the feeder bluffs along the shoreline. Historically, these bluffs were a source of sediment and large trees, each supporting structural and biological habitat elements for juvenile salmon. Specifically, sediment from this source was probably important as a substrate for eelgrass and small crustaceans, important habitat and food resource (respectively) for juvenile salmon. Ample portions of waterfront land have been created by filling what was once intertidal beach. To accomplish this, bulkheads were built in the intertidal areas using rock and other erosion resistant materials and then the spaces behind these bulkheads were filled to create dry land. The result is a shoreline that is not only armored, but much steeper compared to natural shorelines; and usually without the trees and natural vegetation that can be found in undeveloped shorelines. This armoring has generally altered the substrate from soft material and a gently sloping incline to hard material with a steep incline.

The Duwamish River was a major river estuary before 1853. Typically such an estuary provides habitat elements necessary for the survival of juvenile chinook salmon by providing osmoregulatory transitions (conversion from freshwater to saltwater habitats) and rearing habitat as well as holding habitats for adult salmon waiting to ascend the river to spawning grounds. Juvenile chinook salmon normally use side channels for feeding, avoiding predators, and resting, while undergoing their physiological change to salt water. Rapid growth also occurs in estuaries due to the abundance of preferred food. The historical migration routes of anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated and historical saltwater transition zones are lacking (Kerwin 1999).

In the Lower Duwamish Waterway, the riverbanks have been straightened, steepened, hardened, and denuded of riparian vegetation. Kellogg Island presents the majority of the remaining intertidal wetlands in the Duwamish estuary (Simenstad, *et al.* 1991). Current research shows that juvenile chinook salmon are using these restoration sites on their emigration from the Green/Duwamish River (Goetz 2002, COE pers. comm).

These changes to the shoreline habitats in Elliott Bay and the Duwamish River have reduced the preferred habitat for juvenile salmon, thus reducing the probability of survival of those stocks of chinook salmon that depend on these areas as habitat.

The water and sediment quality of Elliott Bay and east central PS ranges from degraded to properly functioning, depending on specific location. Typically, water quality suffers from street runoff, Combined Stormwater Outfall (CSO) discharges, petroleum products from various human activities, treated and untreated effluent discharges, pesticides and fertilizers, and garbage from people working and living on the water. The nearshore sediment ranges from contaminated to clean. Various levels of contamination can be found in sediment and contaminants include heavy metals, Poly Aromatic Hydrocarbons (PAHs), and a variety of other compounds. The waterfront adjacent to Seattle and the Duwamish Estuary contain contaminants from turn-of-the-century activities, industrial liquid wastes, and the deliberate dumping of material into the nearshore waters of Elliott Bay and the Duwamish River. Releases from CSOs deliver a wide range of contaminants to Elliottt Bay and the Duwamish River. All of these sources have contributed to the contamination of sediments in the Duwamish River and Elliott Bay. Some of the nearshore benthic environment has been cleaned in recent years. Thus there is a patchwork of sediment that ranges from clean to contaminated.

2.1.2.4.4 Commencement Bay

Numerous activities affect the present environmental baseline conditions in the action area including expanding urban development, railroads, shipping, logging, agriculture, and other industries. The present port area of Tacoma was created during the late 1800s and early part of the 1900s by filling the tidal marsh that had developed on the shelf of the Puyallup River delta.

Continuing habitat alterations such as dredging, relocation and diking of the Puyallup River, dredging/construction of the waterways for purposes of navigation and commerce, steepening and hardening formerly sloping and/or soft shorelines with a variety of material, and the ongoing development of the Port of Tacoma and other entities has resulted in substantial habitat loss (Sherwood *et al.* 1990; Simenstad *et al.* 1993).

Historically, this area was the estuarine delta of the Puyallup River. With the growth and development of Tacoma, its port, and the surrounding region, the delta has been subjected to dramatic environmental changes, primarily from dredging and filling to create the waterways. Past development activities along the shorelines of Commencement Bay have affected, and future activities may affect, the habitat and the fish that use it (Duker*, et al.* 1989). It has been estimated that of the original 2,100 acres of historical intertidal mudflat, approximately 180 acres remained in 1993 (COE, *et al.* 1993). Fifty-five acres of the 180 acres of low gradient habitat is located near the mouth of the Puyallup River, twenty acres is the Milwaukee habitat area, 18 acres is located bayward of the East Eleventh Street bridge in the Hylebos Waterway, 54 acres are located in the rest of the Hylebos Waterway, 46 acres is present along the shoreline from the mouth of the Hylebos to Browns Point, and eight acres are located in the Blair Waterway (PIE 2001). Graeber (1999) states that 70% of Commencement Bay estuarine wetlands and over 96% of the historic Puyallup River estuary wetlands have been lost over the past 125 years. The historical migration routes of anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated and historical saltwater transition zones are lacking (Kerwin 1999). Additionally, the chemical contamination of sediments, in certain areas of the Bay, has compromised the effectiveness of the habitat (COE, *et al.* 1993; USFWS and NOAA 1997).

In 1981, the U.S. Environmental Protection Agency (EPA) listed Commencement Bay as a Federal Superfund site. As a result of this, the clean up of contaminants has been a high priority and has resulted in 63 of 70 sites remediated (Kerwin 1999). In 1993-1995, the entire Blair Waterway navigation channel was dredged as part of the Sitcum Waterway Remediation Project. Contaminated sediments were removed and capped in the Milwaukee Waterway nearshore confined disposal site. After the completion of the dredging, the EPA deleted the Blair Waterway and all lands that drain to the Blair Waterway from the National Priorities List (PIE 2001).

Two new pier construction projects in Commencement Bay have recently undergone ESA consultation with NOAA Fisheries: the Edman Holdings LLC. Wharf on the Hylebos Waterway (NOAA Fisheries 2002a) and the Pierce County Terminal Expansion Project on the Blair Waterway (NOAA Fisheries 2002b). These projects will increase the total area within Commencement Bay that are covered by overwater structures, but the impacts have been reduced through the conversion of uplands to intertidal habitats.

The shorelines of Commencement Bay have been highly altered by the use of riprap and other materials to provide bank protection. Blair Waterway comprises seven percent of the total of bulkheads that cover 71% of the length of the Commencement Bay shoreline. Based on shoreline surveys and aerial photo interpretation of the area, approximately five miles, or 20% of the Commencement Bay shoreline, is covered by wide overwater structures (Kerwin 1999). These highly modified habitats generally provide poor habitat for salmon (Spence *et al.* 1996).

From 1917 to 1927, most of the habitat alteration (162 acres of mudflat, 72 acres of marsh) resulted from dredging the various waterways and from filling to build uplands for piers, wharves, and warehouses (USFWS and NOAA 1996). The outer portion of the Blair Waterway was constructed during this time. Currently, natural aquatic habitats are highly fragmented and dispersed across the delta and Bay with few natural corridors linking them. Fish preferentially occupy shallow water, including mitigation and restoration sites (Miyamoto *et al.* 1980; Duker, *et al.* 1989; PIE 1999) both north and south of the river mouth, although perhaps tending more to the north (Simenstad 2000). The use of Commencement Bay as a rearing and migration corridor has been documented (PIE 1999; SASSI 1992; Duker *et al.* 1989; Simenstad 1993; 2000). Some modified and relict habitats and most mitigation habitats along the delta front and in the waterways still support juvenile salmon by providing food and refuge. Whether juvenile salmon suffer decreased growth and condition, and thus increased mortality, by their migration through and residence in the delta-Bay system remains unresolved, and certainly not quantified (Simenstad 2000).

At present, salmonid habitat within Commencement Bay shorelines is gradually increasing in acreage because of habitat restoration projects and natural processes. Approximately 50 acres of intertidal and shallow subtidal habitat have been created through previous restoration actions.

The Port currently comprises 2,400 acres of upland that support numerous commercial or industrial activities located on or adjacent to each of the waterways (Blair, Hylebos, and Sitcum). Some of these industries include pulp and lumber mills, shipbuilding and ship repair facilities, shipping docks, marinas, chlorine and chemical production, concrete production, aluminum smelting, oil refining and food processing plants, automotive repair shops, railroad operations, and numerous other storage, transportation, and chemical manufacturing plants.

2.1.3 Effects of the Proposed Action

NOAA Fisheries must consider the estimated extent of injury and mortality from the effects of the proposed action. ESA regulations define “effects of the action” as “the direct and indirect effects of an action on the species or habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline” (50 CFR 402.02). “Indirect effects” are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

2.1.3.2 Direct Effects

Direct effects are the immediate effects of the project on the species or its habitat. Direct effects result from the agency action and include the effects of interrelated and interdependent actions. Future Federal actions that are not a direct, interdependent, or interrelated effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated (50 CFR 402.02).

The direct effects of the project derive from the nature, extent, and duration of the construction activities in the water and whether the fish are migrating or rearing at that time. Direct effects of the project also include immediate habitat modifications resulting from the project. In the proposed project, immediate positive effects include the restoration of a currently degraded beach on Ediz Hook which juvenile PS chinook and HCSR chum, and their prey species, use. Negative effects may occur during various construction activities, including the construction of overwater structures and alteration to nearshore habitats from overwater structures, dredging of intertidal and shallow nearshore areas and armoring the shoreline.

2.1.3.1.2 Pile Driving

The project will require the installation of approximately 194 hollow steel piles: 150, 24-inch diameter piles to support the temporary work trestle at the east end of the HC bridge; four, 30-inch diameter and 30, 12-inch diameter piles at the Port Gamble POF terminal; four, 30-inch diameter piles at the Southpoint POF terminal; and three 24-inch diameter piles for the dolphins at the graving dock site. In addition, approximately 500 feet of temporary steel sheet pile will be driven across the entrance to the graving dock during construction, approximately 200 feet of which will be driven inwater. Due to substrate characteristics at the bridge site, all piles for the temporary work trestle will be driven with an impact hammer, as will those for the dolphin at the graving dock site, while those at the other sites will be driven with a vibratory hammer, if possible. When vibratory hammers are used, “proofing” of the pile with an impact hammer may be necessary to determine bearing capacity.

Biological effects to PS chinook and HCSR chum may result from the high sound pressures produced when driving piles with an impact hammer. However, as discussed below, the FHWA will implement measures to minimize these effects.

Impact driving of steel piles can produce intense sound pressure waves that can injure and kill fishes (*e.g.*, Longmuir and Lively 2001; Stotz and Colby 2001; Stadler, pers. obs. 2002; Blomberg pers. comm. 2003; Carman pers. comm. 2003; Desjardin, pers. comm. 2003). The injuries caused by such pressure waves are known as barotraumas, and include hemorrhage and rupture of internal organs, including the swimbladder and kidneys in fish, and damage to the auditory system. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Fishes with swimbladders (which include salmonids) are sensitive to underwater impulsive sounds (sounds with a sharp sound pressure peak occurring in a short interval of time) because of swimbladder resonance, which is believed to occur in the frequency band of most sensitive hearing (usually 200 to 800 Hz) (Caltrans 2002). As the pressure wave passes through a fish, the swimbladder is rapidly squeezed due to the high pressure and then rapidly expanded as the underpressure component of the wave passes through the fish. At the high sound pressure levels (SPL) associated with pile driving, the swimbladder may repeatedly expand and contract, hammering the internal organs that cannot move away since they are bound by the vertebral column above and the abdominal muscles and skin that hold the internal organs in place below the swimbladder (Gaspin 1975). This pneumatic pounding may result in the rupture of capillaries in the internal organs as indicated by observed blood in the abdominal cavity, and maceration of the kidney tissues (Caltrans 2002).

Another mechanism of injury and death is “rectified diffusion,” which is the formation and growth of bubbles in tissue caused by regions of high SPL. Growth of bubbles in tissue by rectified diffusion can cause inflammation and cellular damage because of increased stress and strain (Vlahakis and Hubmayr 2000; Stroetz, *et al.* 2001), and blockage or rupture of capillaries, arteries and veins (Crum and Mao 1996).

Hastings (2002) expects little to no physical damage to aquatic animals for peak sound pressures below 190 dB (re: 1 µPa), the threshold for rectified diffusion (Crum and Mao 1996) (*note: all decibel levels discussed hereafter will be with a reference pressure of 1 µPa*). However, much uncertainty exists as to the level of adverse effects to fish exposed to sound between 180 and 190 dB_{peak} due to species-specific variables. Turnpenny*, et al.* (1994) reported a mortality rate of 57% for brown trout (*Salmo trutta*), 24 hours after exposure to 90-second bursts of pure tones at 95 Hz at peak pressures below 173 dB. The authors suggested that the threshold for continuous sounds was lower than that for pulsed sounds such as seismic airgun blasts. This difference is thought to be due to the longer duty cycle of the pure tone bursts. The literature also suggests there may be adverse effects stemming from shifts in hearing, physical hearing damage, or equilibrium problems (Turnpenny, *et al.* 1994; Hastings, *et al.* 1996). Based on this information, NOAA Fisheries has established the threshold for physical harm at 180 dB_{peak} for this project.

Sound pressure levels expressed as “root-mean-squared” (rms) values are commonly used in behavioral studies. Sound pressure levels in excess of 150 dB_{rms} are expected to cause temporary behavioral changes such as elicitation of a startle response or behavior associated with stress. These SPLs are not expected to cause direct permanent injury, but, as discussed above, may decrease a fish’s ability to avoid predators. Shin (1995) reports that pile driving may result in “agitation” of salmonids indicated by a change in swimming behavior. Observations by Feist, *et al.* (1992) suggest that sound levels in this range may disrupt normal migratory behavior of juvenile salmon. They also noted that when exposed to the sounds from pile driving, juvenile pink and chum salmon were less likely to startle and flee when approached by an observer than were those that were shielded from the sounds. Based on this information, NOAA Fisheries has established the threshold for behavioral disruption at 150 dB_{rms} for this project.

Driving hollow steel piles of the size proposed for this project can produce SPLs measured at 10m from the pile, as high as 210 dB_{peak} (Woodbury, pers.comm. 2003; Desjardin 2003, pers. comm.), which is 30 times more intense than the threshold value for physical injury. Clearly, these SPLs are sufficiently high to present a lethal threat to fishes, as evidenced by the number of species, including salmonids, killed during impact driving of 24, 36 in dia. steel piles (*e.g.*, Longmuir and Lively 2001; Stotz and Colby 2001; Stadler, pers. obs. 2002; Blomberg pers. comm. 2003; Carman pers. comm. 2003; Desjardin, pers. comm. 2003). Vibratory hammers produce peak pressures that are approximately 17 dB lower than those from impact hammers, (Nedwell and Edwards 2002), yielding an estimated peak SPL of 193 dB for the piles used in this project. While this is above the threshold for physical injury (180 dB), no fish-kills have been linked to the use of vibratory hammers. The lack of evidence does not mean that vibratory hammers are harmless, but they are, clearly, less harmful than impact hammers.

The sounds from the two types of hammer differ in not only in intensity, but in frequency and impulse energy (the rate at which the pressure rises) as well. Most of the sound energy of impact hammers is concentrated between 100 and 800 Hz, the frequencies thought to be most harmful to fishes, while the sound energy from the vibratory hammer is concentrated around 20 to 30 Hz. Additionally, during the strike from an impact hammer, the pressure rises much more rapidly than during the use of a vibratory hammer (Carlson, *et al.* 2001; Nedwell and Edwards 2002). Hubbs and Rechnitzer (1952) found that underwater explosions from black powder charges were less lethal to fishes than those from dynamite, even though the peak pressure was approximately twice as high. The difference was determined to be the much higher impulse energy of the dynamite.

Just as these two sounds are different, so are the behavioral responses of fishes to them. Most of the energy in the sounds produced by vibratory hammers is at the frequency of vibration, around 20 to 30 Hz, very near the range of infrasound (less than 20 Hz). Fishes have been shown to avoid infrasound, but not sounds at 150 Hz (Enger, *et al.* 1993; Dolat 1997; Knudsen, *et al.* 1997; Sand, *et al.* 2000), and habituation to the sound does not occur, even after repeated exposure (Dolat 1997; Knudsen, *et al.* 1997). These studies found that the response requires particle accelerations greater than 0.01 m/s^2, that the response to infrasound is limited to the nearfield (less than 1 wavelength), and that the fish must be exposed to the sound for several seconds to elicit the response. Since the sounds from vibratory hammers are very near the frequency of infrasound, and are of long duration, they may elicit an avoidance response (Carlson, *et al.* 2001). The response to impact hammers is, however, quite different. Fishes may react to the first few strikes of an impact hammer with a “startle” response. After these initial strikes, the startle response wanes and the fishes may remain within the field of a potentially harmful sound (Dolat 1997; NOAA Fisheries 2001b). The sounds from impact driving of steel piles have too little energy in the infrasound range and are too brief to elicit the avoidance response (Carlson, *et al.* 2001). Thus, impact hammers may be more harmful than vibratory hammers for two reasons: first they produce pressure waves with greater potential to harm fishes and second, the sounds produced do not elicit an avoidance response in fishes, which will expose them for longer periods to those harmful pressures.

Most reports of fish-kills associated with pile driving are limited to those fishes that were immediately killed and floated to the surface. However, physical harm to juvenile salmonids is not always expected to result in immediate, mortal injury – death may occur several hours or days later, while other injuries may be sublethal. Necropsy results from Sacramento blackfish exposed to high SPLs showed fish with extensive internal bleeding and a ruptured heart chamber were still capable of swimming for several hours (Abbott and Bing-Sawyer 2002). Sublethal injuries can interfere with the ability to carry out essential life-functions, such as feeding and avoiding predators.

Small fishes that are subjected to high SPLs may also be more vulnerable to predation, and the predators, themselves, may be drawn into the potentially harmful field of sound by following injured prey. The California Department of Transportation (cited in NOAA Fisheries 2003) reported that the stomach of a striped bass killed by pile driving contained several freshly consumed juvenile herring. It appears this striped bass was feeding heavily on killed, injured, or stunned herring as it, too, swam into the zone of lethal sound pressure. Due to their piscivorous nature, adult salmonids may be drawn to an area of dangerously high SPL by the smaller fishes that are injured or killed.

Not all fishes killed by pile driving float to the surface. At the Port of Vancouver, BC, divers found a large number of dead fishes, including salmonids, had sunk to the bottom (Desjardin, pers com). Teleki and Chamberlain (1978) found that up to 43% of the fishes killed by underwater explosions sank to the bottom. With few exceptions, fish-kills are reported only when dead and injured fishes are observed at the surface. Thus, the frequency and magnitude of such kills may be underestimated.

The effects to fishes of the high SPLs produced by impact driving of steel piles depend on several factors, including the size and species of fish. At Bremerton, WA, approximately 100 surfperches (*Cymatogaster aggregata* and *Embiotoca lateralis*) were killed during impact driving of 30-inch diameter steel pilings (Stadler, pers. obs. 2002). The size of these fish ranged from 70 mm to 175-mm fork length. Dissections revealed that the swimbladders of the smallest of the fishes (80mm FL) were completely destroyed, while those of the largest individual (170mm FL) were nearly intact. Damage to the swimbladder of *C. aggregata* was more was more severe than to similar sized *E. lateralis*. These results indicate size and species-specific differences. These results agree with those of Yelverton, *et al.* (1975) who found size and species differences in injury from underwater explosions. Due to their size, adult salmon can tolerate higher pressure levels (Hubbs and Rechnitzer 1952), and injury rates are expected to be less than that of juvenile fish.

The potential for injury to fishes from pile driving depends on the type and intensity of the sounds produced. These are greatly influenced by a variety of factors, including the type of hammer, the type of substrate and the depth of the water. Firmer substrates require more energy to drive piles into, and produce more intense sound pressures. Because piles at the temporary work trestle site must be driven into a layer of glacial till, the SPLs generated are expected to be higher than those in softer substrate, and will likely exceed the 180 dB_{peak} threshold for physical injury.

For construction of the proposed project, the FHWA has agreed to ensure the installation of the piles for the POF terminals with a vibratory hammer, if possible. However, those at the temporary work trestle and the graving dock will require an impact hammer. All pile driving will be limited to July 16 through February 15 to minimize the exposure of juvenile PS chinook and HC summer-run chum to potentially harmful SPLs. Based on the documented emigration rate, Tynan (1997) estimated that the majority of the juvenile HCSR chum will exit HC by the end of April, and are, therefore, not expected to be in the action area when pile driving is occurring. While most juvenile PS chinook will have completed their outmigration from the action area by this time, recent evidence indicates that they are in the nearshore from late January/early February through September, and it is possible that they may be found in the nearshore year-round (Williams, *et al.* 2001; Hirschi, *et al.* 2003). Therefore, they may be exposed to the effects of pile driving during the usual inwater work windows. Returning adults of both species are expected to pass through the action area while pile-driving operations are occurring, and may be at risk as well.

To minimize the potential risk to juvenile PS chinook and adults of both species, the FHWA has agreed to a program of hydroacoustic monitoring of the underwater SPLs for a subset of the piles during impact-driving, and implement sound attenuation measures if the following thresholds are exceeded. If the SPLs exceed 150 dB_{rms} for more than 50% of the impacts, or ever exceed 180 dB_{peak}, a bubble curtain system will be deployed. The efficacy of a bubble curtain is dependent upon the current regime where they are used. Currents above 1.6 kts can disperse the bubbles downstream, away from the pile. To counter this effect, the FHWA has provided a design for an enclosed bubble curtain that is expected to function in the high current areas of HC. Deployment of a bubble curtain is expected to attenuate the peak SPLs by approximately 20 dB (a 90% reduction in sound energy). However, a bubble curtain may not bring the peak and rms SPLs below the established thresholds, and some low level of take may still occur. Without a bubble curtain, peak SPLs from pile driving, (measured at 10 m) will be approximately 210 dB_{peak}. With a bubble curtain, SPLs are estimated at approximately 190 dB_{peak} and 170 dB_{rms}. Using the spherical spreading model to calculate attenuation of the pressure wave (TL = 50*log(R1/R2)), physical injury to sensitive species and life-history stages may occur up to 31m from the pile driver, and behavioral effects up to 100 m. However, studies on pile driving and underwater explosions suggest that, in addition to attenuating peak pressure, bubble curtains also reduce the impulse energy and the resulting potential for injury (Keevin and Hempen 1997; Desjardin pers. comm. 2003). Additionally, sound pressure attenuates more rapidly in shallow water (Rogers and Cox 1988). As a result, the actual range of deleterious effects may be considerably smaller than estimated.

The small range of physical injury, combined with the expected low numbers of the smallest, shore-bound PS chinook outmigrants at the time of pile driving and the assumption that larger juvenile and adult PS chinook and adult HCSR chum are less affected by the behavioral changes brought by pile driving, leads NOAA Fisheries to believe that this activity will have negligible adverse effect to listed salmonids.

2.1.3.1.2 Pile Removal

All of the temporary piles will be removed at the completion of the project, as will a number of existing piles. This activity may adversely affect ESA-listed salmonids by suspending sediments, which may increase turbidity, suspend contaminants from the sediment and bury important habitats such as submerged vegetation. The FHWA has proposed to remove these piles with the direct pull or clamshell method.

The amount of sediment that is suspended during pile removal depends, to a large degree, on the method used. Vibratory pile removal tends to cause the sediments to slough off at the mudline, resulting in relatively low levels of suspended sediments and contaminants. Vibratory pile removal is gaining popularity because it can be used on all types of piles, providing that they are structurally sound. Breaking or cutting the pile below the mudline may suspend only small amounts of sediment, providing the stub is left in place and little digging is required to access the pile. Direct pull or use of a clamshell to remove piles, however, may suspend relatively large amounts of sediment and contaminants. When the pile is pulled from the substrate using these two methods, large amounts of sediment clinging to the pile will slough off as it is raised through the water column, producing a potentially harmful plume of turbidity and/or contaminants. The use of a clamshell may suspend additional sediment if it penetrates the substrate while grabbing the pile. An alternative to removal of the broken/cut stubs is to drive the stub, using a pile driver, sufficiently below the mudline to prevent release of contaminants into the water column.

The affects on water quality (suspended sediments and chemical composition) from direct pull or clamshell removal of piles can have a detrimental impact on salmonids. Suspended sediments can have an adverse affect on migratory and social behavior as well as foraging opportunities (Bisson and Bilby 1982; Sigler, *et al.* 1984; Berg and Northcote 1985). Servizi (1988) observed an increase in sensitive biochemical stress indicators and an increase in gill flaring when salmonids were exposed to high levels of turbidity (gill flaring allows the fish to create sudden changes in buccal cavity pressure, which acts similar to a cough). If sediments are suspended in sufficient quantities, they may bury important habitats, such as the eelgrass beds adjacent to the temporary work trestle. Eelgrass provides foraging opportunities and refugia to juvenile salmonids (Thom, *et al*. 1989; Williams, et al. 2001), and is spawning substrate for an important prey species, Pacific herring (*Clupea harengus*). Spawning by herring has been documented in the eelgrass beds near the temporary trestle.

Most of the piles to be removed are the steel piles used for the temporary structures. However, some creosote-treated wood piles will be removed at the Ediz Hook beach restoration site and others may be removed as part of the eelgrass mitigation required by the HPA. These piles are a chronic source of PAHs, a contributing factor to declining water quality in many parts of PS. Therefore, ESA-listed salmonids are expected to benefit from their removal.

Vibratory pile removal suspends the least amount of sediment and is the method preferred by NOAA Fisheries. Piles at the temporary work trestle will be removed with a trestle-mounted crane that will begin at the waterward end and work toward the shoreline. Vibratory removal of these piles is not practical because the technique could the structure. Vibrations transmitted through the trestle to the supporting piles may cause destabilization by liquefying the sediments around these piles. Therefore, the direct pull method will be required. While the currents in HC are expected to dissipate the turbidity plume rapidly, nearby eelgrass beds could still be affected. Shaking or hitting the pile before pulling will break the sediment-pile bond, less sediment will cling to the pile as it is pulled, and less sediment will be suspended. Sediment suspension can also be reduced by pulling the pile slowly to allow more sediment to slough off at the substrate.

2.1.3.1.3 Overwater Structures

Three temporary overwater structures will be built for the project, totaling 3.44 acres: the work trestle at the east end of the HC bridge (3.24 acres); the pier, ramp and float for the POF at Port Gamble (0.11 acre); and the pier, ramp and float for the POF at South Point (0.09 acre). These structures will extend from the upland, crossing the intertidal zone and reaching to the subtidal zone. Additionally, temporary moorage of the bridge pontoons and anchors will increase overwater coverage by up to 6.11 acres.

Adverse biological effects to PS chinook and HCSR chum may result from these structures due to the alteration of light, wave energy, substrate type, and water quality–the primary factors controlling the plant and animal assemblages found at a particular site. However, as described below, the FHWA will implement several conservation measures that are expected to reduce the overall effect of these structures on ESA-listed salmonids.

Alteration of light, wave energy, substrate type, depth and water quality by overwater structures can interfere with key ecological functions such as spawning, rearing, and refugia. Studies summarized by Simenstad, *et al.* (1999) suggest that changes in the underwater light environment affect juvenile salmonid physiology and behavior. Juvenile chinook and chum salmon are directly affected by shading, due to the loss of shallow nearshore habitat that is used for migration, feeding and refuge from predators. Site-specific factors (*e.g.*, water clarity, current, depth, etc.) and the type and use of a given overwater structure determine the occurrence and magnitude of these impacts (Nightingale and Simenstad 2001). Much of the following description of the effects of overwater structures on salmonids is taken, unless otherwise cited, from a recent, comprehensive literature review by Nightengale and Simenstad (2001).

Overwater structures create a shadow that reduces the light levels below. The size, shape and intensity of the shadow cast by a particular structure depend upon its height, width, construction materials, and orientation. High and narrow piers and docks produce narrower, more diffuse shadows than do low and wide structures. Increasing the numbers of pilings used to support a given pier increases the shade cast by pilings on the under-pier environment. In addition, less light is reflected underneath structures built with light-absorbing materials than from structures built with light-reflecting materials. Structures that are oriented north-south produce a shadow that moves across the bottom throughout the day, resulting in a smaller area of permanent shade than those that are oriented east-west.

The shadow cast by an overwater structure affects both the plant and animal communities below the structure. Distributions of plants, invertebrates and fishes have been found to be severely limited in under-dock environments when compared to adjacent, unshaded vegetated habitats. Light is the single most important factor affecting aquatic plants. Under-pier light levels have been found to fall below threshold amounts for the photosynthesis of diatoms, benthic algae, eelgrass and associated epiphytes and other autotrophs. These photosynthesizers are an essential part of nearshore habitat and the estuarine and nearshore food webs that support many species of marine and estuarine fishes. Eelgrass and other macrophytes can be reduced, or eliminated, through even partial shading of the substrate, and have little chance to recover.

Most fishes rely on sight for spatial orientation, prey capture, schooling, predator avoidance, and migration. The reduced-light conditions under an overwater structure limit the ability of fishes, especially juveniles and larvae, to perform these essential activities. Shading from overwater structures may also reduce prey organism abundance and the complexity of the habitat by reducing aquatic vegetation and phytoplankton abundance (Kahler, *et al.* 2000; Haas, *et al.*

2002). Glasby (1999) found that epibiotic assemblages on pier pilings at marinas subject to shading were markedly different than in surrounding areas. Other studies have shown under-structure epibenthos reduced relative to that in open areas. While prey organisms will still be produced by the shaded habitat, it will be produced at a significantly lower rate (Carman 2000, pers. comm.). To the extent that prey organisms are still present, their availability to, and utilization by, chinook and chum will be significantly reduced (Simenstad, *et al.* 1985, Simenstad 2000). These factors are thought to be responsible for the observed reductions in juvenile fish populations found under piers, and the reduced growth and survival of fishes held in cages under piers, when compared to open habitats (Able, *et al.* 1998; Duffy-Anderson and Able 1999).

In a review of the effects of overwater structures on salmonids, Simenstad, *et al.* (1999), found that the responses of juvenile salmon were extremely size-dependent. The smaller the fish, the more their migration appeared behaviorally constrained to the shallow water habitats, and the more likely they were to avoid entering shaded habitats. Furthermore, salmon fry tend to use both natural refuge (*e.g.*, vegetation such as eelgrass) and darkness (*e.g.*, shading from docks and floats and turbidity) as refuge but migrate along these edges rather than penetrate them. Studies of the under-pier ecology of juvenile pacific salmon in Commencement Bay confirmed that chinook preferred to migrate along the edge of the pier, rather than pass under it (Ratte and Salo 1985).

The degree to which salmonids behavior is affected by a shadow will depend, in large part, on the contrast between ambient light levels and the shaded area. If the contrast is great, the fishes may alter their behavior by moving along the perimeter of the structure, away from their preferred shallow-water habitat, or by hesitating at the edge of the shadow before passing under the structure. The time required for physiological adaptation to changing light levels vary across species and life stages. At the juvenile stage, the time required for light-adapted chum and pink fry to fully adapt to dark conditions was found to range from 30 to 40 minutes. However, the time required for dark-adapted fry to adapt to increased light conditions was found to range from 20 to 25 minutes. During these periods of transition, the juvenile chum's visual acuity ranges from periods of blindness to a slightly diminished capacity, depending upon the magnitude of light intensity contrasts. As the animals become older, the time required for light adaptation generally shortens. The time necessary to adapt to the dark, on the other hand, tends to increase with age. The progression of retinal changes from one state to another is influenced by the intensity of the introduced light and the intensity of light to which the fish have been previously exposed. Contrasts in light levels determine the progression of changes the eye undergoes with previous light levels affecting the speed of transition. Fish previously exposed to higher light intensities become dark-adapted more slowly than those previously exposed to lower light intensities. This physiological change is thought to be responsible for the observed reluctance of juvenile salmonids to cross into the shadow cast by overwater structure.

Juvenile salmonids that encounter an overwater structure may be at greater risk of predation. The shadow cast by an overwater structure may increase predator success by creating a light/dark interface that allows ambush predators to remain in a hidden in a darkened area and ambush prey that swim past in brightly lit conditions (Helfman 1981). In addition to piscivorous predation, these structures also provide perching platforms for avian predators such as double-crested cormorants (*Phalacrocorax auritis*); from which they can launch feeding forays or dry their plumage. The extent to which this project might contribute to, or increase, the existing opportunity for predation is difficult, if not impossible, to gauge. The individual elements of overwater structures included in the proposed project are discussed in more detail below.

2.1.3.1.3.1 Temporary Structures

The temporary work trestle, and the shadow cast by it, will extend from the uplands, across the intertidal zone and out to the subtidal zone. Outmigrating juveniles of PS chinook and HCSR chum travel through the shallow nearshore habitats and will encounter this structure for three consecutive years. Foraging success is not expected to be significantly affected by the structure due to its relatively narrow design, the small amount of eelgrass that will be shaded, and the lush eelgrass beds that are adjacent to the bridge (Simenstad, pers. comm. 2002b).

A small amount of eelgrass was found in the area that will be shaded by the work trestle by Simenstad, *et al.* (2001) and Woodruff, *et al.* (2002). Since the trestle will be in place for up to four years, those eelgrass beds are expected to be heavily impacted by the shade (Williams, pers. comm. 2003).

To minimize the effect to juvenile salmonids by the shadow cast by the trestle, the FHWA has agreed to implement an adaptive management plan to illuminate the under-trestle environment at levels sufficient for unimpeded passage by outmigrating juveniles. To minimize the effects to eelgrass, the FHWA proposes to remove, hold and propagate the shoots from the shaded beds, and then replant them after the trestle is removed. If these plans are successfully implemented, NOAA Fisheries expects that the trestle will have a minimal adverse effect on ESA-listed salmonids. However, if the plans fail, the adverse effects described above will be more severe.

The temporary pier, ramp, and float for the Port Gamble POF terminal will extend from the upland to depths of minus 15 feet MLLW, and the temporary ramp and float for the South Point POF terminal will extend from an existing pier out to minus 10 feet MLLW. Juveniles of PS chinook and HCSR chum will encounter these structures for one outmigration season. The FHWA has designed the pier and ramps to be narrow and elevated above the water to minimize the size and intensity of the shadows cast by these structures. The floats have been located as far from shore as practicable, in depths greater than minus 10 feet MLLW to reduce the potential for creating a physical barrier to outmigration. Submerged vegetation (various species of algae) that is shaded by the floats is expected to recover quickly, once the structures are removed. The effects of these structures on outmigrating juvenile salmonids have been greatly reduced by these design features. However, while the POF terminals are scheduled to be operated for eight weeks (May - June), the structures are scheduled to be in place from January through mid-July. Juvenile HCSR chum will be present in the vicinity of the POF terminals from mid-February through late April (Tynan 1997), while outmigrant PS chinook are expected to be present from March to June. Therefore, any adverse effects from the structures, including migration barriers and shading of submerged vegetation, will be experienced by outmigrants for a total of six months, beyond the two months of POF operations.

Disruption of outmigration could be further reduced by installing the overwater portions (all but the piles) of the pier, ramps and floats shortly before POF operations begin, and removing them shortly after operations have ceased. While this will require some inwater work, NOAA Fisheries expects such activities to disrupt juvenile outmigrants less than the operation of the POF vessels or the existence of the structures. Note that any application of herbicide or pesticide is not analyzed and specifically not exempted from the take prohibition through the Incidental Take Statement attached to this Opinion.

2.1.3.1.3.2 Moorage of pontoons and anchors

The sites for mooring anchors and attaching necessary components to the pontoons have not yet been selected, but three general locations have been identified by the FHWA: Elliott Bay; Commencement Bay; and Port Angeles Harbor. The manner in which the anchors and pontoons will be moored is also unknown. They may be moored to shoreline structures or a mix of shoreline and offshore moorage sites. Shoreline structures may be pile-supported piers or bulkheads. While offshore moorage offers the best protection for ESA-listed salmonids, shoreline moorage is required to outfit the pontoons and may be used exclusively. Outfitting is expected to require up to 16 months, and will likely occur during the outmigration period for PS chinook and HCSR chum.

The degree to which ESA-listed salmonids are affected by the anchors and pontoons will be greatly influenced by the design and location of the structure to which they are moored. Structures which provide a functional, nearshore migration corridor for juvenile salmonids (*e.g.*, those with under-pier illumination, pier windows, T-shapes, etc.) will have less effect on outmigrating juveniles than those lacking such features.

2.1.3.1.3.2.1 Elliott Bay

Juvenile PS chinook occur in the Lower Duwamish Waterway from early March through late July (Meyer, *et al.* 1981; Low and Myers 2002). Other studies have found juvenile chinook salmon in the Duwamish as early as mid February (K. Fresh pers. comm. 2003). Weitkamp and Schadt (1982) collected chinook in the lower Duwamish through late August, the end of their sampling period. Although juvenile chinook are present in the Lower Duwamish Waterway over an 8-month period, catch data show an abrupt increase in smolts in mid-May followed by an equally abrupt decrease. This indicates that most of the fish represented in the pulse of abundance were not in the Lower Duwamish Waterway for more than two weeks (Warner and Fritz 1995).

Similar to timing of juvenile chinook emigration peaks in the Duwamish estuary, increasing abundances of juvenile chinook have been observed in Elliot Bay, but only through the summer months. Taylor, *et al.* (1999) found the greatest numbers of juvenile chinook at Terminal 5, located immediately west of Harbor Island, in mid-May, and at Pier 91, located four miles north of the Duwamish, in early June. Weitkamp and Schadt (1982) found PS chinook through late August, the end of their study period, but numbers peaked from April to late June.

Pontoons could be moored in Elliott Bay for up to 16 months and disrupt the outmigration of juvenile PS chinook for two consecutive years. The project, as proposed, did not include any measures to minimize this potential disruption.

2.1.3.1.3.2.2 Commencement Bay

At Commencement Bay, the effects of pontoon moorage on outmigrating juvenile PS chinook will vary, depending on the particular waterway, and the location within the waterway. Studies summarized in Section 2.1.2.2 showed that: juvenile chinook are present in low numbers in March and April; peak in late May or early June and drop to low numbers again by July 1; the progeny of naturally spawned chinook arrive in the estuary throughout this period at a variety of lengths; offshore catches of chinook peak about two weeks later than shoreline catches; all shorelines are used but catches are typically higher near the mouths of the waterways than near the heads, and that catch per unit was higher in the waterways closest to the river.

Pontoons could be moored in Commencement Bay for up to 16 months and disrupt the outmigration of juvenile PS chinook for two consecutive years. The project, as proposed, did not include any measures to minimize this potential disruption.

2.1.3.1.3.2.3 Port Angeles Harbor

Of the three possible locations - Port Angeles harbor, Elliott Bay and Commencement Bay - the temporal and spatial pattern of use by salmonids at Port Angeles is the least understood. While virtually no data are available from Port Angeles, the location is on the outmigration route of most juvenile PS chinook and all juvenile HCSR chum. By the time that most PS chinook reach Port Angeles, they will be relatively large and no longer tied to the nearshore, should be able to migrate around the perimeter of the pontoons with little effect, while others may migrate quickly and reach the Port Angeles area at a relatively small size (Simenstad, pers com 2002a). These smaller fish will be less able to navigate around the pontoons and may suffer greater effect. Consequently, NOAA Fisheries believes that mooring the pontoons and anchors at a shoreline structure when juvenile PS chinook and HCSR chum are migrating along the shoreline may have an adverse effect.

Pontoons could be moored in the harbor at Port Angeles for up to 16 months and disrupt the outmigration of juvenile PS chinook and HCSR chum for two consecutive years. The project, as proposed, did not include any measures to minimize this potential disruption.

2.1.3.1.4 Dredging

Approximately two acres of intertidal subtidal habitat will be dredged to minus 20 feet MLLW to create the entrance channel to the graving dock. Biological effects to PS chinook salmon and HCSR chum may result from: (1) temporary reduction inwater quality and increased noise disturbance associated with dredging that may exclude juveniles from the nearshore habitat; (2) potential exposure to contaminated sediments or water; and (3) temporary loss of benthic organisms and other prey due to disturbance of the channel substrate. However, as discussed below, the FHWA will implement measures to reduce these effects.

Sediment plumes are likely to arise from dredging for the proposed project. Dredging activities disturb and suspend sediment creating discoloration of the water, reducing light penetration and visibility, and changing the chemical characteristics of the water. The size of the sediment particles and tidal currents are typically correlated with the duration of sediment suspension in the water column. Larger particles, such as sand and gravel, settle rapidly, but silt and very fine sediment may be suspended for several hours. Lasalle (1988) described a downstream plume that extended 900 feet at the surface and 1,500 feet at the bottom. Lasalle (1988) also noted an increase in sediment levels upwards of 70% from the effect of the pressure wave created by the bucket as it descended through the water.

The affects on water quality (suspended sediments and chemical composition) from dredging can have a detrimental impact on salmonids. Suspended sediments can have an adverse affect on migratory and social behavior as well as foraging opportunities (Bisson and Bilby 1982; Sigler, *et al.* 1984; Berg and Northcote 1985). Servizi (1988) observed an increase in sensitive biochemical stress indicators and an increase in gill flaring when salmonids were exposed to high levels of turbidity (gill flaring allows the fish to create sudden changes in buccal cavity pressure, which acts similar to a cough). The chemical composition of the water is also affected by dredging activities. Estuarine sediments are typically anaerobic and create an oxygen demand when suspended in the water column, and in turn would decrease DO levels (Hicks, *et al.* 1991; Morton 1976). Decreases in DO levels have been shown to affect swimming performance levels in salmonids (Bjornn and Reiser 1991). The decrease of swimming performance due to decreases in DO could directly affect the fishes' ability to escape potential predation or could affect their ability to forage on motile fish. Lasalle (1988) found DO levels in the mid-to-upper water column were decreased by 16 to 83% and nearly 100% near the bottom. Smith, *et al.* (1976) found DO levels up to 2.9 milligrams per liter (mg/l) during dredging activities in Grays Harbor. Hicks (1999) observed salmon avoidance reactions when DO levels dropped below 5.5 mg/l. Dredging fine sediments such as those found in Port Angeles Harbor may create a sediment plume that could create poor water quality (*i.e.*, decreased DO levels) that might disrupt nearshore migration of juvenile chinook and chum salmon. In addition to the fine sediments at Port Angeles, the nearshore habitats have accumulated a large amount of wood debris (Pentec 2001), which may contribute to the occurrence of low oxygen events during dredging activities (SAIC 1999).

Disruption of the channel bottom and entrainment of juvenile salmonids by dredging has a negative impact on benthic biota and forage fish. Dredging physically disturbs the channel bottom; eliminating or displacing established benthic communities and reducing prey availability to juvenile salmon or their forage species. Filter feeding benthic organisms can suffer from clogged feeding structures, reduced feeding efficiency, and increased stress levels (Hynes 1970). Dredging may also suppress the ability of some benthic species to colonize in the dredged area, thus creating a loss of benthic diversity and food source for the chinook salmon prey species. However, benthic communities at the proposed site are expected to recover within one year after dredging activities are completed, resulting in a temporal loss versus long-term loss. A number of studies at the Port of Tacoma, Port of Seattle, and other locations within urban environments have examined the recolonization of intertidal and shallow substrate that has been disturbed (Jones and Stokes Associates 1990a; 1990b; 1995; Hiss, *et al.* 1990). The results indicated that recolonization is rapid and that substantial densities of prey are available within a short period (months) of substrate disturbance (PIE 2001).

To limit the effects of dredging to PS chinook and HCSR chum, the FHWA will ensure that dredging will occur between July 16 and February 14, a time when juveniles of these species are expected to be present in low numbers. Adherence to the proposed conservation measures will ensure that turbidity plumes are greatly reduced. Use of a mechanical clamshell dredge will cause limited short-term and localized turbidity. If a barge is used to transport the dredged material, dredge material or turbid water will not be discharged into waters of the state. NOAA Fisheries believes that minimum short-term, and no long-term, adverse effects will result from the temporary increases in turbidity.

Turbidity plumes can be further reduced by making each pass with the clamshell bucked complete. Partially full buckets should not be lowered back into the water; instead they should be emptied in the normal manner.

2.1.3.1.5 Vessel Operation

This project will require the operation of POF vessels and tugboats at the Port Angeles graving dock. The POF vessels will dock at floats located in relatively shallow water (at Port Gamble, the waterward edge of the float is located in depths between minus 10 and minus15 feet MLLW and at South Point, the landward edge is at approximately minus 15 feet MLLW). The POF vessels will operate between Port Gamble and South Point. Tugs used to remove pontoons and anchors from the graving dock must navigate the entrance channel, the bottom of which will be at minus 20.6 feet MLLW.

POF vessel operation may adversely affect ESA-listed salmonids by creating large wakes that can impact the shoreline of HC between Port Gamble and South Point. Both the POF and tugboat operations can produce scouring of the substrate with powerful currents from propellers, *i.e.*, prop wash. However, as discussed below, the FHWA will implement measures to minimize the effects from vessel operations.

The characteristics of the wake produced by a vessel are dependent, in part, on the speed of operation. According to an analysis of the wakes produced by the POF vessels (PIE 2002), wakes in excess of 2-3 feet, or higher, were expected from vessels operating at a speed of 25 knots. The analysis suggested that wakes of this size would cause adverse effects to the shoreline of HC. Included in the report was a recommendation to implement an adaptive management approach to selecting the operational speed of the vessels, and provided two options. Based on this analysis, the FHWA will start with a vessel speed of 20 knots, to be reduced to 18 or 16 knots if the wake is significantly larger than those from other boats in the area. This adaptive approach, combined with the relatively short period of operation (two months), leads NOAA Fisheries to believe that the effects of POF vessel wakes on the shoreline of HC will be minimal.

Prop wash from vessels can disturb the substrate inwater as deep as 30-40 feet (Ebbesmeyer, pers. comm. 2000). Substrate effects include removal of fine sediments, dislodging and burying of benthos, and turbidity. Substrates can become scoured and rearranged, disrupting the detrital food webs that provide food for the epibenthic prey of juvenile salmonids. Studies at ferry terminals have demonstrated the adverse effects of prop wash on plants and substrate surfaces (Thom, *et al.* 1996; Thom and Shreffler 1996). Suspension of sediments by prop wash can increase turbidity levels. Several studies have documented direct mortality, avoidance, reduced feeding and growth, respiratory impairment and physiological stress from suspended sediments (Simenstad 1988; Newcombe and MacDonald 1991; Waters 1995).

Outmigration may be disrupted in two manners: through avoidance of highly turbid areas and by direct displacement by the prop wash currents. Typically, fishes avoid areas of high turbidity. Suspended sediment levels of 88 to 100 mg/l elicited avoidance responses in coho salmon, rainbow trout and Arctic grayling (Newcombe and MacDonald 1991). Observations at a ferry terminal found that prop wash from a docking vessel created currents which disrupted schools of fish and washed them deep under the pier (Hooper, pers. comm. 2002).

The FHWA has incorporated several measures to reduce the adverse effects of prop wash at the POF terminals. First, the floats have been located as far from the shoreline as practical to minimize the potential for prop wash to impact the habitat used by juvenile salmonids. Second, the FHWA will establish a slow-down area at each terminal. At Port Gamble, the slow-down area extends 300 feet from the float, and at South Point, slow-down will begin 300 feet from the minus 10 feet MLLW contour line. When operating at slower speeds, less energy is required for braking when docking and for acceleration when departing the dock. As a result, the prop wash will be weakened and less scour will occur. Although the POF vessels will be operating during the outmigration period of juvenile salmonids, NOAA Fisheries expects the effects of these vessels operation to fishes will be minimal.

At the graving dock, tugboats will operate within the entrance channel and in the surrounding nearshore waters. Since the bottom of the entrance channel will be constructed at minus 20.6 feet MLLW, and the gate is likely to open during the outmigration period, substrate scour and disruption of outmigration are expected to occur. Tugboat operations will likely be limited to periods of relatively high tide, reducing bottom scour. Since no data are available on the temporal or spatial use of Port Angeles Harbor, the extent to which fish migration is disrupted cannot be determined.

2.1.3.1.6 Graving Dock Operations

The graving dock, to be constructed at Port Angeles, will be opened at various times of the year to remove bridge pontoons and anchors. The schedule for opening the gate is not known at this time. This activity can adversely affect PS chinook and HCSR chum by entraining them in the dock when the gate is closed. However, as will be discussed below, the FHWA will implement measures to reduce the level of this effect.

Each opening of the gate will provide an opportunity for PS chinook and HCSR chum to enter the lower channel area and become trapped when the gate is closed. Removal of fishes that become trapped in the graving dock when the gate is closed will require handling and may result in injury or death to those fishes. Since the temporal and spatial pattern by which juvenile PS chinook and HCSR chum utilize the waters around Port Angeles is virtually unknown, it is impossible to estimate the number of those fishes that will become trapped in the graving dock. However, studies of US Navy drydock operations designed to investigate the effect of operations on juvenile salmonids provide some insight into the potential for entrapment to occur in these types of facilities (SAIC 2000). Entrapment studies from March through June of 2000 demonstrated that large numbers of juvenile salmonids can be trapped. In late July, for example, the gate was open for 5.5 hours, trapping 69 juvenile chinook, 172 juvenile chum and 22 juvenile coho. Since the opening to the proposed graving dock is almost twice as wide as that for the drydocks (170 feet vs. 90 feet), it is reasonable to assume that there is a greater potential to trap juvenile salmonids. Furthermore, the studies showed a positive relationship between catch per unit effort (fish/hour) and the time that the gate was left open, a result that is not unexpected. Considering that the gate to the graving dock will be open for extended periods of time – up to 48 hours - it is, again, reasonable to assume that the potential to trap juvenile salmonids is greater than that for the drydocks. However, the potential for such structures to trap fishes is dependant upon the abundances of those fishes in the immediate area. Since those abundances are unknown for Port Angeles, it is impossible to predict the entrapment rate. While the number of salmonids that become trapped in the graving dock is unknown, if opened during the outmigration period, it is reasonably certain that some ESA-listed salmonids will be trapped, and individuals will be injured or killed.

The FHWA has agreed to implement several conservation measures designed to reduce the likelihood and extent of effects associated with operation of the graving dock. These measures will reduce the number of fishes that become trapped when the gate is closed, and reduce the risk of physical injury to those that are trapped. Measures to reduce the number of fishes trapped in the dock include flooding/draining through screened pumps and "herding" fishes out of the lower level of the dock with a large seine net prior to closing the gate. Since seining is not expected to herd all fishes from the dock, the dock has been designed to facilitate removal of those fishes that are trapped. Design features include a 3-ft deep, 2-ft wide channel around the perimeter that is linked to several removable fish-boxes. After the water level is drawn down, fishes will be gently herded down the channel into the boxes. A crane will then lift the water-filled boxes out of the dock and gently release the fishes into the harbor. The exact protocol for removing fishes is still in development, but will be completed and approved by NOAA Fisheries prior to the first opening of the gate. Although there are no data available to predict when juvenile salmonids utilize the harbor at Port Angeles, it is assumed to be highly probable that some ESA-listed fish will be in the area during at least some of the openings. Therefore, NOAA Fisheries believes that take is reasonably certain to occur. However, this activity is intended to reduce the amount effects fishes would experience if fish-removal did not take place, and is viewed by NOAA Fisheries as a beneficial activity in the context of this proposed action.

Effects to listed salmonids might be further reduced with the use of a bubble screen across the entrance when the gate to the graving dock is open. The US Navy routinely uses bubble curtains on their drydocks, with mixed results (SAIC 2000). Although bubble screens do not appear to reduce the number of salmonids trapped in the drydocks, they do reduce the number of other species, particularly forage fishes. If fewer fishes are trapped in the graving dock, ESA-listed salmonids will be easier to remove and subjected to less stress, increasing the likelihood of survival. Preliminary discussions with the FHWA/WSDOT indicate that while using a bubble curtain is feasible, for reasons of stability, it cannot be operated during gate opening or closing operations.

2.1.3.1.7 Water Quality

2.1.3.1.7.1 Chemical Contamination

Construction activities associated with this project will take place over, or adjacent to, the marine waters of HC, Port Angeles and perhaps PS. Adverse effects to listed salmonids may occur through the release of chemical contaminants into surrounding waters. However, as discussed below, the FHWA will implement measures to reduce the potential for such releases.

As with all construction activities, accidental release of fuel, oil, and other contaminants may occur. Operation of the back-hoes, excavators, and other equipment requires the use of fuel, lubricants, etc., which, if spilled into the channel of a water body or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum based contaminants (such as fuel, oil, and some hydraulic fluids) contain PAHs which can cause acute toxicity to salmonids at high levels of exposure and can also cause chronic lethal and acute and chronic sublethal effects to aquatic organisms (Neff 1985). Vines, *et al.* (2000) attributed the low survival rate of herring eggs attached to creosote-treated piles in San Francisco Bay to the PAHs contained in the creosote.

The FHWA will require the contractor to submit a SPCC plan at each work site. These plans, if properly designed and implemented, are believed to be sufficient to minimize the effect of construction activities on the quality of surrounding waters. However, if not properly designed and implemented, chemical contamination may adversely affect listed species.

2.1.3.1.7.2 Stormwater

Stormwater runoff, resulting from construction activities associated with this project, will be delivered to the waters of HC, Port Angeles Harbor, and Elliott Bay and/or Commencement Bay. The sources of stormwater runoff entering HC are the temporary access roads at the bridge and the POF terminals. Sources at Port Angeles include the construction and operation of the graving dock, beach restoration activities and outfitting the pontoons. If Elliott Bay and/or Commencement Bay are selected for outfitting the pontoons, stormwater runoff may enter those water bodies. Adverse effects to ESA-listed salmonids may result from stormwater discharge by the delivery of sediments and contaminants to nearshore marine waters. However, as discussed below, the FHWA has incorporated a number of measures intended to minimize the potential adverse effects associated with the discharge of stormwater.

Stormwater-based water quality limitations have been identified as examples of potential causes of injury to listed fish in both final and draft regulations developed to implement the ESA (NOAA Fisheries, 1998a;1998b). Runoff from urban, or industrial areas, has been shown to contain many different type of pollutants, depending on the nature of the activities in the area (WDOE 2001). Water quality limitations are associated with triggering the onset of sublethal effects such as disease in previously infected salmonid populations. The onset of disease is thought to be exacerbated by the added stress of poor water quality conditions (NOAA Fisheries 1998b). In addition, factors associated with urbanization, including pollutants, have been implicated in 58% of the declines and nine percent of the extinctions among 417 surveyed stocks (NOAA Fisheries 1998a).

At the temporary access roads, POF terminals and graving dock, TESC have been developed and Stormwater Pollution Prevention plans (SWPP) will be developed by the contractor. These plans, if properly implemented, are believed to be sufficient to minimize the effect of construction activities on water quality. However, TESC and SWPP plans have not been developed for the potential pontoon-outfitting sites. Based on these plans, NOAA Fisheries believes that the adverse effects from construction-related stormwater runoff will be minimal.

2.1.3.1.7.3 Groundwater

During construction of the graving dock, the excavated area will be dewatered by pumping groundwater from a number of wells that will be drilled around the perimeter and inside the channel area. The FHWA/WSDOT has developed a plan to treat the water for quality, but not quantity, prior to discharge to the harbor. The groundwater will be pumped to an on-site treatment facility, consisting of an oil-water separator, wet pond and bioswale. After treatment, the water will be discharged into an existing 24” pipe and into the harbor. Once the graving dock drainage system is completed, treated groundwater will discharge onto riprap located immediately in front of the gate. Based on the proposed treatment plan, NOAA Fisheries believes that groundwater discharge will not adversely affect listed species.

2.1.3.1.8 Entrance Channel Construction

Approximately two acres of intertidal and subtidal habitat will be dredged to -20.6 feet MLLW to create the entrance channel to the graving dock. Approximately 330 feet of existing shoreline will be degraded. One-hundred seventy feet of the shoreline will be converted to deepwater (greater than -20 feet MLLW), and the remaining 166 feet will be sloped at a ratio of 2 to1 from the MHHW line (+6.39 feet MLLW), down to -20.6 feet MLLW. Stabilization of the of the channel will require placing 2,000 cubic yards of riprap along the 160 feet of shoreline and approximately 660 feet of side slope. The riprap will extend from the MHHW line down to the bottom of the channel. This stabilization is necessary to prevent failure of the side slopes and slow the infilling of the channel. Approximately 9.55 acres of upland that was, historically, intertidal habitat will be permanently converted to an industrial facility (graving dock) that will provide virtually no habitat for PS chinook and HCSR chum, and reduces the likelihood that the historical habitat will be restored.

Biological effects on juvenile PS chinook and HCSR chum may result from the loss of intertidal and shallow subtidal habitats and changes in benthic prey communities resulting from shoreline stabilization. However, as discussed below, the FHWA has incorporated measures that will reduce these effects.

Juvenile salmon tend to emigrate along the shoreline in shallow water, particularly at younger and smaller life history stages. The long-term effects of dredging include changes in the volume and area of habitat and changes to primary and secondary production (food web effects) (Nightingale and Simenstad 2001). Dredging for the entrance channel will remove approximately two acres of the important shallow nearshore habitat, adversely affecting ESA-listed salmonids.

Bank hardening structures, such as riprap, interrupt the natural wave energy regime, which interferes with sediment recruitment and longshore transport. The use of shoreline stabilization methods can also alter substrate composition, increase the slope of the shoreline, and affect the natural succession of riparian plants (Kerwin 1999). Besides simplifying shorelines and reducing intertidal habitat area (Douglas and Pickel 1999) these modifications have direct effects on nearshore processes and the ecology of many species (MacDonald, *et al.* 1994; Thom and Shreffler 1994). For example, the composition of benthic substrate in nearshore marine and estuarine habitats is linked to local physical conditions and greatly influences biological resource functional benefits (Williams and Thom 2001). In two studies reviewed by Cordell and Simenstad (1988), where comparisons were made between a uniform hard substrate (pier aprons, boat ramp) and adjacent “natural” substrates, species richness and density were lower on the hard substrate. The authors inferred that replacement of soft or unconsolidated sediment with rock or concrete probably results in decreased epibenthic production. When the present, degraded condition of the nearshore habitat in Port Angeles is considered, any loss of epibenthic prey production is significant.

Dredging the entrance channel and armoring the side slopes and shoreline is expected to adversely affect listed salmonids in two ways: first, the shallow, nearshore habitat preferred by juveniles salmonids will be reduced and second, replacing the natural, finer-grained substrate with a hard, steeply sloped, riprap covered surface is expected to reduce the prey available to juvenile salmonids. However, some of the loss of habitat and prey will be offset by the proposed shoreline restoration in the Port Angeles harbor, as described below.

2.1.3.1.9 Shoreline Restoration

The Washington State HPA, issued for the proposed construction of the graving dock, requires the FHWA/WSDOT to mitigate for the loss of nearshore habitat. To fulfill this requirement, the FHWA/WSDOT will restore 1,000 feet of upper intertidal shoreline along a currently degraded beach on Ediz Hook, as described in Section 1.2.10.

Adverse effects from this activity include sediment delivery to, and elevation of turbidity levels in, marine waters and disruption of forage fish spawning. However, the FHWA has incorporated several conservation measures to minimize the adverse effects associated with restoration activities. Delivery of sediment and elevation of turbidity levels will be avoided by conducting all restoration work when the area is exposed by the tides and the implementation of appropriate BMPs.

Sandlance (*Ammodytes hexapterus*) are an important prey species for salmonids (Hart 1973), and are known to spawn along the beaches on Ediz Hook (Burkle, pers. comm. 2003). The eggs of this species are intertidal, and are susceptible to elevated levels of turbidity, such as expected from the beach restoration activities. However, sandlance are expected to avoid beaches with ongoing activities, and will spawn elsewhere. In order to minimize the possibility of affecting the eggs of sandlance, the FHWA has agreed to begin restoration activities prior to the onset of spawning, and work on a continuous basis until restoration is complete. If work is disrupted, it will not resume until the next available work window.

The short-term impacts of the restoration activities have been appropriately addressed by the FHWA. Additionally, restoring the beach will provide long-term benefit to ESA-listed salmonids by increasing the shallow water habitat utilized by outmigrating juveniles, removing a chronic source of input for wood debris and creosote, improving spawning habitat for an important prey species and removing an obstruction to longshore transport of sediments.

2.1.3.1.10. Interrelated and Interdependent Actions

Effects of the action are analyzed together with the effects of other activities that are interrelated to, or interdependent with the proposed action. An interrelated action is one that is part of the proposed action, or depends on the proposed action for its justification. An interdependent action is one that has no independent utility apart from the proposed action (50 C.F.R. 402.02). During formal consultation, the post-project operation of the graving dock and the disposition of the pontoons that will be replaced were raised as possible interrelated and interdependent actions. However, these actions do not fit the definition of interrelated and interdependent actions, and are more accurately described as indirect actions. The uncertainty surrounding these actions precluded any analysis of their indirect effects on ESA-listed species, and they were not included in the consultation.

2.1.3.2 Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur (50 CFR 402.02). Indirect effects may occur outside the area directly affected by the action. Positive indirect effects are improvements to the quality of stormwater runoff from the bridge and a reduction in the intertidal footprint of the piers supporting the approach spans. Negative indirect effects from this project are limited to potential impacts to eelgrass beds in the vicinity of the bridge. There are no other indirect effects at the project site since this action will not increase the capacity of the bridge to carry traffic.

When construction of the pontoons and anchors is finished, the graving dock will be turned over to the Port of Port Angeles. However, the manner in which the Port will use the facility is currently unknown. For that reason, operations by the Port are not reasonably certain to occur, and are therefore not considered in this consultation. Similarly, the fate of the existing pontoons, after they are removed, is unknown, and cannot be analyzed in this consultation.

2.1.3.2.1 Water Quality

At the completion of this project, the roadway on the HC Bridge will be 10 feet wider than it is currently, and will present an increase in impervious surfaces. Impervious surfaces used for transportation generate pollutants which are discharged to surface waters. Typical pollutants include oil and grease, sediments, PAHs, lead, zinc, copper and cadmium (WDOE 2001). However, since stormwater from the bridge will be discharged directly into HC, water quality will not be adversely affected by the project, and will actually be improved due to the conservation measures agreed to by the FHWA.

Currently, untreated stormwater runoff from the east approach span is discharged directly onto the intertidal habitat below the bridge. Eelgrass beds in the vicinity of the bridge are documented spawning sites for herring, and may be adversely affected by the current discharge location. When the project is completed, stormwater runoff will pass through an oil-water separator and be discharged at the end of the span, in deeper water away from the eelgrass beds. Runoff from the floating portion of the bridge and the west approach will not receive any treatment due to limited area for treatement. However, the FHWA has agreed to ensure the bridge is periodically swept to remove roadway contaminants. The schedule for sweeping will be determined prior to completion of the project, but will include sweeping before the fall rains occur to minimize the delivery of accumulated contaminants into the HC.

2.1.3.2.4 Shading of Eelgrass by the Hood Canal Bridge

Widening of the approach spans by 10 feet will cast a wider shadow on the shoreline below, and may affect the existing eelgrass beds adjacent to the bridge. This may adversely affect PS chinook and HCSR chum because these eelgrass beds play an important role in their life-history by providing refuge and foraging habitat. However, as discussed below, the FHWA has incorporated conservation measures to reduce the magnitude of the effect.

At the east and west termini, a general lack of eelgrass continuity close to the bridge was noted by Woodruff, *et al.* (2002). However, continuous beds were mapped on both sides at varying distances from the bridge. Within two kilometers of the bridge along the eastern shoreline, eelgrass beds are relatively continuous, except for within 240 feet to the south and 320 feet meters to the north of the bridge, which are relatively unvegetated (Simenstad, *et al.* 2001). Simenstad, *et al.* (2001) could not speculate whether or not the observed discontinuity in eelgrass distribution is due to the presence of the bridge. However, they did note that the shoreline geomorphology and orientation is not significantly different from other slight points along the nearshore to the south of the bridge where eelgrass patch structure remains contiguous. If the shadow cast by the bridge contributes to the lack of adjacent vegetation, the wider shadow of the new approach structures will expand the area being affected. The eelgrass beds adjacent to the eastern terminus are documented as herring spawning habitat.

The FHWA will implement a program to monitor the adjacent eelgrass beds to determine if they are affected by the wider approach structures. If monitoring confirms that eelgrass in the shadow of the bridge has been reduced, replacement is required by the HPA. According to the HPA, preferred replacement is by removal of overwater structures, pilings, anchors, or other debris from over and within existing eelgrass beds in the project vicinity that are also documented spawning beds for herring. Removal performed in advance and monitored for eelgrass recovery shall be done at a 2 to 1 ratio, on an area per area basis, for eelgrass lost. Removal performed after the fact shall be done at a 4 to1 ratio if full eelgrass recovery is attained within the first year after project completion, a 5 to 1 ratio if attained in the second, a 6 to1 ratio in the third, etc. until all eelgrass has been replaced. Off-site replacement in other documented spawning beds for herring shall require twice the area for each category. Off-site replacement in an area that is not used by herring for spawning shall require four times the area for each category. Monitoring of replaced eelgrass beds for five years is also required.

Considering the mitigation for eelgrass-loss, required by the HPA and agreed to by the FHWA, NOAA Fisheries expects that the long-term, overall effects of the project on eelgrass will be minimal.

2.1.4 Cumulative Effects

Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR 402.02). Numerous non-Federal actions that could affect listed and proposed species are reasonably certain to occur within the HC bridge project action area. These will typically include development projects without Federal funding or Federal permit requirements, timber harvest operations on state and private lands, mining activities that do not require Federal permitting and do not occur on Federal land, agricultural activities excluding federally permitted water diversions or federally subsidized operations, fish harvest, recreational activities, and point/non-point pollution discharge. Each of these future activities could contribute to the cumulative effects on listed and proposed species or their habitat.

2.1.4.1 Hood Canal Bridge Site

The HC bridge site is subject to ongoing recreation associated with boat traffic and fishing in HC. Other recreation activity is likely to occur along the shorelines near both bridge termini. Single-family residential development is likely to occur in the action area. However, the extent of development is likely to be limited to a few homes as the available area is limited.

The expected continued increase in population in the PS region will likely result in a proportionate increase in recreation activity in the action area. It will also stimulate development. An increase in the amount of boat traffic in HC will result in an increase in pollution from boat exhaust and increased disturbance. More single-family development will result in an increase in impervious surface that could contribute to increased erosion; a potential increase of pollution discharge from fertilizers, automobiles, etc., loss of native habitat, and more human disturbance.

2.1.4.2 South Point Ferry Terminal

The anticipated cumulative effects at the South Point ferry terminal site would be similar to those at the HC bridge portion of the action area. In addition, the action area associated with the South Point ferry terminal site could experience small-scale timber harvest or mining of sand and gravel in the terrestrial areas. Forest lands managed for timber production occur within this portion of the action area. Both activities could degrade or eliminate native habitats and increase disturbance levels. These activities would result in slight increases in pollution discharge, primarily from boat engine exhaust.

2.1.4.3 Port Gamble Ferry Terminal

The anticipated cumulative effects at the Port Gamble ferry terminal site would be similar to those at the South Point ferry terminal portion of the action area. However, because of the proximity to Port Gamble, a slightly higher chance exists for future development, increased recreation, and increased pollution in this portion of the action area.

2.1.4.4 Fred Hill/Shine Pit Park and Ride

Potential cumulative effects at this site primarily include timber harvest and mining. The Shine Pit is an abandoned gravel pit and the surrounding land consists primarily of managed timber lands. Due to its location, this portion of the action area has a low potential for future development.

2.1.4.5 Seattle Waterfront/Port of Seattle Anchor and Pontoon Moorage Site

This portion of the action area is largely developed, but could experience more development or redevelopment in the future. Any such development would likely cause only slight environmental damage and could provide some improvements such as reductions in pollution discharge. The amount of fishing, boating, and commercial ship traffic in Elliott Bay may increase slightly over existing conditions as the population in the PS region increases over time. This will result in more pollutants entering Elliott Bay and an increase in disturbance.

2.1.4.6 Commencement Bay Anchor and Pontoon Moorage Site

Similar to the Seattle Waterfront/Port of the Seattle site, the Commencement Bay portion of the action area is largely developed. It could experience some development or redevelopment in the future, but it would likely cause only slight environmental damage and could provide some improvements such as reductions in pollution discharge. The amount of fishing, boating, and commercial ship traffic in Commencement Bay may increase slightly over existing conditions as the population in the south PS region increases over time, thereby elevating disturbance levels and pollution discharge in Commencement Bay.

2.1.4.7 Port Angeles Graving Dock

Because of its urbanized setting, cumulative effects at the Port Angeles graving dock portion of the action area would be limited, but would primarily include increased disturbance and pollution discharge from increases in recreational and commercial boat/ship traffic. Other impacts could result from future development, especially in shoreline areas.

2.1.4.8 Puget Sound Barge Travel Lanes

The aquatic areas within PS and the Strait of Juan De Fuca are subject to recreational boating and commercial ship traffic which are likely to increase commensurate with the expected population increase in western Washington. An increase in boat traffic will elevate disturbance levels and increase the amount of pollutants entering PS.

2.1.4.9 Cumulative Effects to Species

Future development in shoreline areas and increased boat traffic in the action area could result inwater quality degradation that could impact HCSR chum and PS chinook and their prey species. Future development near the PS shoreline and tributary streams could also increase sediment discharge in peripheral areas of PS. Increased pollutant and sediment discharge is most likely to have an adverse affect on rearing salmonids that occur in near-shore habitats within the action area. Existing regulations are expected to ameliorate the discharge of pollutants and sediment from these future actions.

Increased fishing could adversely affect listed salmon that occur in the action area by increasing the inadvertent capture of individuals. However, fishing-related impacts will be moderated through the regulation of commercial and recreational fishing to protect listed fish. Increased boat traffic could result in minor disturbance of listed salmon that occur in the action area. However, the effect of this disturbance is expected to be minimal.

2.1.5 Integration and Synthesis

NOAA Fisheries determines whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for jeopardy. NOAA Fisheries' process for making jeopardy determinations must consider the estimated level of injury or death attributable to: (1) collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any indirect or cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages. If NOAA Fisheries concludes that the action will jeopardize the species it must identify any reasonable and prudent alternatives available.

NOAA Fisheries reviewed the status of PS chinook and HCSR chum, the environmental baseline for the action area, and the direct, indirect, and cumulative effects of the proposed action. By itself, the proposed bridge retrofit and replacement project will temporarily reduce the ecological function of the habitat, but will not preclude long-term improvement in habitat conditions in the action area. NOAA Fisheries has identified a number short- and long-term adverse effects that will result from this project.

Impact driving of steel piles for the temporary structures can injure and kill fishes, but timing restrictions and a commitment to utilize a bubble curtain will minimize the extent of this effect. The shadow cast by the temporary overwater structures could disrupt outmigration of juvenile PS chinook and HCSR chum and impact eelgrass beds. However, the FHWA has incorporated measures, such as underpier lighting and narrow structures to minimize the extent of disruption and monitoring with mitigation, to minimize the extent of effects on eelgrass. Operation of vessels at the POF terminals and graving dock could disturb the benthic prey community that is utilized by juvenile PS chinook and HCSR chum. However, the FHWA has incorporated measures to minimize the extent that the POF vessels will disturb the substrate. Construction and operation of the graving dock will destroy intertidal and subtidal habitats used by juvenile salmonids and result in injury or death to those ESA-listed salmonids that become trapped behind the gate to the dock. The extent of these effects have been minimized by the restoration of 1,000 feet of beach near the graving dock, design features that facilitate removal of fishes that become trapped in the dock, and development of a protocol to remove those that are trapped.

Long-term adverse effects to eelgrass may result from the wider shadow cast by the new bridge. However, the FHWA minimize the extent of this effect by implementing a monitoring program, and if adverse effects are found, a mitigation plan to replace the affected eelgrass. Long-term positive effects include the restoration of 1,000 feet of presently degraded upper-intertidal habitat at Ediz Hook and an improvement of the quailty of stormwater runoff from the new bridge.

While this project will result in the above described adverse effects, by incorporating minimizing conservation measures, the proposed action's adverse effects will be offset to the extent that the project will not add effects to the baseline habitat within the action area. As such, the effects of the project are not likely to influence the distribution, reproduction, or numbers of listed fishes in the action area.

2.1.6 Conclusion

NOAA Fisheries determines whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for jeopardy. NOAA Fisheries' process for making jeopardy determinations must consider the estimated level of injury or death attributable to: (1) collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any indirect or cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages. If NOAA Fisheries concludes that the action will jeopardize the species it must identify any reasonable and prudent alternatives available.

NOAA Fisheries has determined that the effects of the proposed action would not likely jeopardize the continued existence of PS chinook or HCSR chum salmon. The determination of no jeopardy is based upon the current status of the species and their biological requirements, the environmental baseline for the action area, and the effects of the proposed action. In arriving at a non-jeopardy conclusion for this action, the minimization measures were important to consider against the incremental degradation, attributable to the proposed overwater structure, relative to the not properly functioning baseline condition of the nearshore environment.

2.1.7 Reinitiation of Consultation

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

2.2 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct of listed species without a specific permit or exemption (50 CFR 222.102). "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to a listed species by "significantly impairing essential behavioral patterns such as breeding, spawning, rearing, migrating, feeding, and sheltering" (50 CFR 222.102). "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action, is not considered prohibited taking provided that such takings is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the amount of any incidental taking of endangered or threatened species. It also provides Reasonable and Prudent Measures (RPMs) that are necessary to minimize the effects and sets forth terms and conditions with which the action agency must comply in order to implement the RPMs.

2.2.1 Amount or Extent of Take Anticipated

As stated in Section 2.2.2, above, PS chinook and HCSR chum use the action area for migration and foraging. Both species are likely to be present in the action area during part of the year such that they would likely encounter the effects of the proposed action. Therefore, incidental take of these species is reasonably certain to occur. The proposed action includes measures to reduce the likelihood and amount of incidental take. To ensure the action agency understands these measures are mandatory, take minimization measures included as part of the proposed action, are restated in the Terms and Conditions provided below.

Take caused by the proposed action is likely in the form of harm, injury or death. Harm is expected to occur in the form of habitat modification, which will impair normal behavioral patterns of listed salmonids. Here, the ability of PS chinook and HCSR chum to use the affected areas to migrate and forage will be diminished by the extent to which these habitats are disrupted in the short- and long-term. Injury or death is expected to occur as a result of the high sound pressure levels produced by pile driving. Injury or death is expected to occur as a result of fish-removal activities necessary for operation of the graving dock. The amount of take from these activities is difficult, if not impossible, to estimate. In instances where the number of individual animals to be taken cannot be reasonably estimated, NOAA Fisheries characterizes the amount as "unquantifiable" and uses a habitat surrogate to assess the extent of take. The surrogate provides a threshold of anticipated take which, if exceeded, provides a basis for reinitiating consultation.

This Opinion analyzes the extent of effects that would result from this project. The extent of take NOAA Fisheries anticipates in this statement is that which would result from the following:

- Conversion of approximately two acres of intertidal and shallow nearshore habitat to deep water (deeper than minus 20 feet MLLW) with armored side slopes and conversion of 9.6 acres of historically intertidal habitat to an industrial facility, precluding the restoration of that habitat;

- Construction of temporary overwater structures that will cover approximately 3.44 acres of intertidal and shallow nearshore habitats;

- Moorage of pontoons and anchors that will increase overwater coverage by up to 6.11 acres;

- Impact driving of approximately 194 hollow steel piles; and

- Removal of listed salmonids that become trapped in the graving dock. The extent of take from this activity is expected to be equivalent to the number of PS chinook and HCSR chum found along 1,090 feet of shoreline, *i.e.*, the outside perimeter of the graving dock. Based on results of fish handling from the early operations, the second opening of the gate during the outmigration period (February 15 - June 30), will trigger a discussion between the FHWA and NOAA Fisheries to determine if further minimization of take is necessary and to adjust the expected extent of take of listed species.

Should any of these parameters be exceeded during the project, the reinitiation provisions of the Opinion shall apply.

Note that take exemptions are not extended to any application of herbicide or pesticide.

2.2.2 Reasonable and Prudent Measures

Reasonable and Prudent Measures are non-discretionary measures to minimize take, that may or may not already be part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(a)(2) to apply. The FHWA has the continuing duty to regulate the activities covered in this incidental take statement. If the FHWA fails to require the applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. The NOAA Fisheries believes that activities carried out in a manner consistent with these RPMs, except those otherwise identified, will not necessitate further site-specific consultation. Activities which do not comply with all relevant RPMs will require further consultation.

The NOAA Fisheries believes that the following RPMs are necessary and appropriate to minimize take of listed fishes resulting from implementation of the action.

The FHWA shall:

1. Minimize the likelihood of incidental take caused by impact-driving of steel piles.

2. Minimize the likelihood of incidental take caused by removal of piles.

3. Minimize the likelihood of incidental take caused by the temporary overwater structures

4. Minimize the likelihood of incidental take caused by the modification of habitats utilized by ESA-listed salmonids.

5. Minimize the likelihood of incidental take caused by the mooring of pontoons and/or anchors to shoreline structures.

6. Minimize the likelihood of incidental take caused by dredging for the entrance channel to the graving dock.

7. Minimize the likelihood of incidental take caused by operation of vessels for this project.

8. Minimize the likelihood of incidental take caused by operation of the graving dock.

9. Minimize the likelihood of incidental take caused by accidental spills of contaminants.

10. Minimize the likelihood of incidental take associated with the delivery of stormwater runoff from the bridge to the waters of HC.

11. Minimize the likelihood of incidental take by ensuring that the conservation measures included with the proposed project are implemented.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the FHWA must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

1 To implement RPM No. 1, the FHWA shall ensure that:

a. a plan is developed and implemented for hydroacoustic monitoring of the peak and rms sound pressure levels generated during impact-driving of steel piles. The plan shall be reviewed and approved by NOAA Fisheries. No monitoring or sound attenuation measures will be required for piles driven in the dry beach at low tide, vibratory driving of any type of pile, or impact driving of wood or concrete piles. During hydroacoustic monitoring, the hydrophone shall be positioned at mid-depths, 10 meters distant from the pile being driven.

i. If sound pressure levels exceed 150 dBrms (re: 1 μPa)(0.032 KPa) for fewer than 50% of the impacts and never exceed 180 dBpeak (re: 1 μPa)(1 KPa), pile driving may proceed without further restriction; or

ii. If rms sound pressure levels exceed 150 dB for 50% or more of the impacts, or peak pressures ever exceed 180 dB, pile driving may continue, but only with the use of a bubble curtain.

(1) Bubble curtains shall be constructed according to the design submitted by WSDOT on January 29, 2003, or other design as approved by NOAA Fisheries.

(2) If an unconfined bubble curtain is used, monitoring must show that it functions at all tidal stages. If it does not, then the confined bubble curtain must be utilized. If a confined bubble curtain is used, no other sound attenuation measures will be required, regardless of the attenuation it provides, or the tidal conditions during use.

(3) The initial hydroacoustic monitoring to establish the sound pressure levels being produced will not be required if a bubble curtain is used for all piles.

(4) If a bubble curtain is deployed, the level of sound attenuation will be determined through hydroacoustic monitoring according to a plan to be developed by the FHWA and submitted for approval by NOAA Fisheries.

iii. Within 60 days of completing the hydroacoustic monitoring at any site, a report shall be submitted to NOAA Fisheries, Washington Habitat Branch, Lacey, Washington. The report shall include a description of the monitoring equipment and for each pile monitored, the peak and rms sound pressure levels with and without a bubble curtain, the size of pile, the size of hammer and the impact force used to drive the pile, the depth the pile was driven, the depth of the water, the distance between hydrophone and pile, and the depth of the hydrophone.

b. During inwater driving of sheet piles with an impact hammer, a bubble screen will be deployed, according to a design to be submitted by WSDOT and approved by NOAA Fisheries.

c. The FHWA shall ensure that, providing substrate conditions are appropriate, vibratory hammers are used to drive all piles at the POF terminals. If substrate conditions are not appropriate, impact hammers may be used. Impact hammers will require hydroacoustic monitoring and use of a bubble curtain if the pressure thresholds are exceeded, as described above, or the use of a bubble curtain without monitoring.

d. The FHWA shall ensure that a plan is developed and implemented to prevent the entrapment of ESA-listed salmonids, and their forage species, during the installation of the temporary cofferdam at the entrance to the graving yard. This plan shall be reviewed and approved by NOAA Fisheries prior to installation of the cofferdam.

2. To implement RPM No. 2, the FHWA shall ensure that:

a. a vibratory hammer is used to remove all piles in areas of fine or contaminated sediments or near beds of eelgrass or macroalgae, providing that conditions are appropriate. Inappropriate conditions for vibratory removal include poor pile condition (primarily for wood piles) and substrate conditions that would destabilize the work platform without driving the piles deeper than otherwise required (*i.e.*, the temporary work trestle). Temporary steel piles in sediments not conducive to vibratory removal (*e.g.*, those at the temporary work trestle) and those pulled when exposed at low tide, may be removed using the direct pull method;

b. when removing structurally sound piles with the direct pull method, the operator shall first hit or vibrate the pile to break the bond between the sediment and the pile to minimize the potential for the pile to break, as well as reduce the amount of sediment sloughing off the pile during removal; and

c. piles that break during removal, or are already broken below the water line, shall be removed with a clamshell bucket or broken off at least three feet below the mudline, and if possible, the hole filled with clean sand. The clamshell shall not penetrate into the substrate more than is necessary to remove the pile. The clamshell shall be emptied of pile debris on the barge before it is lowered into the water. If the bucket contains only sediment, it will remain closed, lowered to the mudline and opened to redeposit the sediment.

3. To implement RPM No. 3, the FHWA shall ensure that:

   a. an under-pier lighting plan is developed and implemented that meets the minimum under-pier light levels established by NOAA Fisheries. The established light levels must be maintained during daylight hours from February 15 through July 14 during the life of the structure. The methods used to achieve these light levels are at the discretion of the FHWA. NOAA Fisheries shall review and approve the under-pier lighting plan;

   b. an under-pier lighting monitoring report is submitted to the Washington State Habitat Branch of NOAA Fisheries, prior to the first fish window after the structure is built. The report shall include ambient light levels measured outside of the shadow of the structure and concurrently measured light levels under the structure; and

   c. all temporary structures are removed at the earliest possible opportunity. Structure removal that does not require inwater work shall be performed as soon as the structure is no longer needed. Inwater work shall be done as soon as allowed by the inwater work window. The exception to the inwater work window is removal of floating structures, such as the POF barges and transfer span, which shall be removed as soon as they are no longer needed.

   d. the portion of the POF terminals that are located in the intertidal and shallow subtidal area, from OHW line waterward to minus 10 feet MLLW, shall not be wider than 8 feet.

4. To implement RPM No. 4, the FHWA shall ensure that:

   a. the Ediz Hook beach restoration habitat improvement components of this project are completed prior to the first outmigration of juvenile salmonids (February 15 - July 15) following placement of the temporary cofferdam at the graving facility. Doing so will minimize the temporal loss of habitat utilized by listed salmonids for foraging; and

   b. rock for the channel armor shall be composed of clean, angular material of a sufficient durability and size to prevent it from being broken up or washed away by high water or wave action;

   c. the voids in the riprap at the graving dock are filled with two and one-half inch minus material (Habitat mix) from the OHW mark down to minus 10 feet MLLW. The material shall be monitored and maintained for the life of the project.

5. To implement RPM No. 5, the FHWA shall ensure that:

   a. during the appropriate fish-window (Elliott Bay: January 15 - July 31; Commencement Bay: February 15 - July 31; and Port Angeles February 15 - June 30) temporary moorage of pontoons and anchors meet one of the following conditions:

i. pontoons and anchors shall be moored at least 100 feet from shore, inwater at least as deep as minus 20 feet MLLW and located so submerged vegetation will not be shaded; or

ii. pontoons and anchors shall be moored to a shoreline structure that provides a functional nearshore migration corridor – one with sufficient illumination and unobstructed passage; or

iii. when moored to a bulkheaded or pile-supported pier that does not provide a functional nearshore corridor (sufficient light and unobstructed passage along the shoreline), the pontoon/anchor must be moored to allow at least 15 feet separation between the pier and pontoon/anchor. Moorage closer to the pier is allowed during inclement weather or when moving heavy loads onto or off of the pontoon/anchor. Such moorage shall be allowed for up to 25% of the normal fish window.

b. As soon as possible after the weather clears or loading/offload is complete, the pontoon/anchor shall be moved at least 15 feet away from the pier.

6. To implement RPM No. 6, the FHWA shall ensure that:

a. each pass of the clamshell dredge is complete; and

b. dredged material shall be disposed of upland such that they do not re-enter surface waters.

7. To implement RPM No. 7, the FHWA shall ensure that:

a. The FHWA shall ensure that the following recommendations, contained in the HC Ferry Vessel and Prop/Jet Wash Analysis (dated February 20, 2002), are implemented:

i. to prevent shoreline erosion from vessel-generated wakes, the POF vessels shall start operations at a speed of 20 knots, and reduce speed to 18 or 16 knots if observations show significant differences between ferry wakes and wakes generated by other boats;

ii. to prevent disturbance of the substrate at Port Gamble, a vessel slow-down area will be established 300 feet from the dock.;

iii. to prevent prop wash damage to eelgrass beds at South Point, a vessel slow-down area shall be established 300 feet from the seaward boundary of the minus 10 MLLW depth contour.

b. the substrate at the entrance to the graving dock, including the finer material on the riprapped channel slopes, is not disturbed by prop wash from tugs moving the anchors and pontoons out of the graving dock. If disturbance is observed, tug operations shall be modified so as to avoid or minimize these effects.

8. To implement RPM No. 8, the FHWA shall ensure that:

   a. for the life of this project, the gate to the graving dock remains closed, except when necessary to remove pontoons or anchors. In addition, the gate shall be left closed at the end of the project;

   b. for the life of this project:

      i. the gate to the graving dock is not opened between the dates of April 1 through May 31, for the protection of outmigrating juvenile PS chinook and HCSR chum; and

      ii. the gate is not opened more than five (5) times during the months of June and July, in any one calendar year.

      iii. NOAA Fisheries reserves the right to modify this restricted period. This may occur if the FHWA presents data demonstrating that the restricted period can be truncated without significantly increasing the take of listed species.

   c. the pump intakes to the graving yard are screened according to the NOAA Fisheries guidelines, found at http://www.nwr.noaa.gov/1hydrop/nmfscrit1.htm and http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm;

   d. prior to flooding, the floor of the graving yard is sufficiently clean to prevent delivery of contaminants to the waters of Port Angeles;

   e. flooding the graving dock is performed according to the plan developed by WSDOT, WDFW and NOAA Fisheries, dated January 3, 2003;

   f. the upper level of the yard is never flooded when fishes are trapped in the lower level;

   g. minimize the number of fishes that are trapped in the graving dock by:

      i. operating a bubble screen, placed across the entrance to the graving yard, while the gate is open. The bubble curtain may be turned off when the gate is being opened and closed, to prevent destabilization of the gate, or at other times when . The design of the bubble screen shall be approved by NOAA Fisheries; and

      ii. pulling a seine net through the lower channel prior to closing the gate. This is intended to herd fishes out of the lower channel.

h. immediately after the gate is closed, the water level is drawn down and all trapped fishes are removed;

i. fish entrained in the graving dock during flooding are removed according to a fish-removal plan, to be developed by the FHWA and approved by NOAA Fisheries prior to the first gate opening. The plan shall include the following provisions:

   i. The fish-removal team shall handle all ESA-listed fishes with extreme care, keeping them inwater to the maximum extent possible during capture and transfer procedure to minimize the stress of out-of-water handling;

   ii. To ensure that fishes are handled appropriately, a trained fish biologist, experienced in the handling of fishes, is present during all fish-removal procedures;

   iii. All ESA-listed salmonids killed or mortally injured during the removal procedures shall be retained, preserved (via freezing or chemical preservation) and turned over to NOAA Fisheries, Washington Habitat Branch, Lacey, Washington, for examination;

   iv. NOAA Fisheries, or its designated representative, shall be allowed to accompany the fish-removal team during the capture and release activity and shall be allowed to inspect the fish handling records and facilities; and

   v. A report of fish handling activities shall be provided to NOAA Fisheries, Washington Habitat Branch, Lacey, Washington, within 30 days of opening the gate. The report shall include the number of ESA-listed fish, by species, that were removed (may be estimated to minimize handling) and the number of ESA-listed fish, by species, that were injured and/or killed during the removal operation. Excessive take of ESA-listed species will require a review and, if necessary, modification of the removal procedure.

   vi. NOAA Fisheries wants to emphasize that exemptions from take for operations of the graving dock are only in effect for this action by FHWA and do not extend to any subsequent operators of that facility.

9. To implement RPM No. 9, the FHWA shall ensure that:

   a. the SPCC developed by the contractor for use during construction of all aspects of the project are sufficient to prevent spills from contaminating waters in the action area;

   b. the spill containment and response plan developed for the long-term operation of the HC Floating Bridge is sufficient to minimize the potential for spills to contaminate the waters of HC, and is implemented prior to re-opening of the bridge to traffic;

c. all equipment, operated such that leaks or spills of fuels and lubricants can be delivered to surface waters, shall be inspected daily and cleaned prior to operation. External oil and grease shall be removed, and wash water must be treated, using appropriate BMPs, prior to discharge into surrounding waters. If a non-fail physical barrier exists to prevent delivery of fuels and lubricants to surface waters (*e.g.*, behind sheet piles or a coffer dam), daily inspection is not required; and

d. vehicle staging, cleaning, maintenance, overnight storage and refueling and fuel storage shall be done a sufficient distance from any waterbody to avoid delivery of contaminants. This distance is generally considered to be at least 150 feet, but will vary according to site characteristics. The only exception is large equipment (*e.g.* cranes), that due to low mobility cannot be moved. Such equipment may be fueled in place, providing they are equipped with a spill containment system, at the discretion of the project engineer in consultation with WSDOT environmental staff and NOAA Fisheries.

10. To implement RPM No. 10, the FHWA shall ensure that a plan is developed to periodically sweep the HC bridge to prevent the delivery of roadway contaminants to HC.

11. To implement RPM No. 11, the FHWA shall ensure that the conservation measures included as part of the proposed project, and described in Section 1.2.1 of this document, are fully implemented.

3.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A));

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g*., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas et al. (1998) provides additional detail on the groundfish EFH habitat complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the FHWA.

3.3 Proposed Actions

The proposed action and action area are detailed above in Section 1.2 of this document. The action area includes habitats that have been designated as EFH for various life-history stages of 46 species of groundfish, four coastal pelagic species, and three species of Pacific salmon (Table 1).

3.4 Effects of Proposed Action

As described in detail in Section 2.3 of this document, the proposed action may result in short- and long-term adverse effects to a variety of habitat parameters. These adverse effects are:

1. Short-term production of high sound pressure levels during impact driving of hollow steel piles. This effect is applicable to groundfish, Pacific salmon and coastal pelagic species;

2. Short-term suspension of sediments and increased turbidity during direct pull of piles. This effect is applicable to groundfish, Pacific salmon and coastal pelagic species;

Table 1. Species with designated EFH occurring in the action area.

Groundfish Species	redstripe rockfish *S. proriger*	Dover sole *Microstomus pacificus*
spiny dogfish *Squalus acanthias*	rosethorn rockfish *S. helvomaculatus*	English sole *Parophrys vetulus*
big skate *Raja binoculata*	rosy rockfish *S. rosaceus*	flathead sole *Hippoglossoides elassodon*
California skate *Raja inornata*	rougheye rockfish *S. aleutianus*	petrale sole *Eopsetta jordani*
longnose skate *Raja rhina*	sharpchin rockfish *S. zacentrus*	rex sole *Glyptocephalus zachirus*
ratfish *Hydrolagus colliei*	splitnose rockfish *S. diploproa*	rock sole *Lepidopsetta bilineata*
Pacific cod *Gadus macrocephalus*	striptail rockfish *S. saxicola*	sand sole *Psettichthys melanostictus*
Pacific whiting (hake) *Merluccius productus*	tiger rockfish *S. nigrocinctus*	starry flounder *Platichthys stellatus*
black rockfish *Sebastes melanops*	vermilion rockfish *S. miniatus*	arrowtooth flounder *Atheresthes stomias*
bocaccio *S. paucispinis*	yelloweye rockfish *S. ruberrimus*	
brown rockfish *S. auriculatus*	yellowtail rockfish *S. flavidus*	**Coastal Pelagic Species**
canary rockfish *S. pinniger*	shortspine thornyhead *Sebastolobus alascanus*	anchovy *Engraulis mordax*
China rockfish *S. nebulosus*	cabezon *Scorpaenichthys marmoratus*	Pacific sardine *Sardinops sagax*
copper rockfish *S. caurinus*	lingcod *Ophiodon elongatus*	Pacific mackerel *Scomber japonicus*
darkblotch rockfish *S. crameri*	kelp greenling *Hexagrammos decagrammus*	market squid *Loligo opalescens*
greenstriped rockfish *S. elongatus*	sablefish *Anoplopoma fimbria*	**Pacific Salmon Species**
Pacific ocean perch *S. alutus*	Pacific sanddab *Citharichthys sordidus*	chinook salmon *Oncorhynchus tshawytscha*
quillback rockfish *S. maliger*	butter sole *Isopsetta isolepis*	coho salmon *O. kisutch*
redbanded rockfish *S. babcocki*	curlfin sole *Pleuronichthys decurrens*	Puget Sound pink salmon *O. gorbuscha*

3. Short-term shading of intertidal and shallow subtidal habitats by temporary overwater structures and temporary moorage of pontoons and anchors. This is applicable to groundfish and Pacific salmon;

4. Long-term conversion of intertidal and shallow subtidal habitats to deeper water. This is applicable to groundfish and Pacific salmon;

5. Long-term reduction of benthic prey organism abundance and diversity from placement of riprap at graving dock channel. This is applicable to groundfish and Pacific salmon;

6. Short-term increases in suspended sediments and turbidity from dredging for the entrance channel to the graving dock. This is applicable to groundfish, Pacific salmon and coastal pelagic species;

7. Short-term disturbance of benthic habitats by prop wash from POF vessels and tugboats. This is applicable to groundfish and Pacific salmon;

8. Construction and operation of the graving dock creates unfavorable habitat that can trap fishes. This is applicable to groundfish, Pacific salmon and coastal pelagic species;

9. Short-term degradation of water quality from accidental spills of fuels and lubricants during construction activities. This is applicable to groundfish, Pacific salmon and coastal pelagic species; and

10. Long-term degradation of the marine waters by discharge of stormwater runoff from the bridge to HC. This is applicable to groundfish, Pacific salmon and coastal pelagic species.

In addition to those adverse effects described in the Opinion, this project will adversely affect designated EFH in HC by:

11. placing 20 large anchors on the bottom of the canal, which will alter the physical characteristics of the substrate. This is applicable to groundfish.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action would adversely affect the EFH for the groundfish, coastal pelagic, and Pacific salmon species listed in Table 1.

3.6 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions that would adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in Section 1.2.1 of this document will be implemented by the FHWA, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. The adverse effects to the substrate from placement of the bridge anchors (adverse EFH effect No. 11) cannot be minimized, and no conservation recommendations are applicable. Therefore, NOAA Fisheries recommends that the FHWA implement the following conservation measures to minimize the remaining adverse effects to EFH for the species in Table 1:

1. To minimize the adverse effect of pile driving (adverse effect No. 1), implement Terms and Conditions 1.a - 1.d in Section 2.6.3;

2. To minimize the adverse effect from suspension of sediments during pile removal (adverse effect No. 2), implement Terms and Conditions 2.a - 2.c in Section 2.6.3;

3. To minimize the adverse effect from the temporary overwater structures (adverse effect No. 3), implement Terms and Conditions 3.a - 3.d and 5.a - 5.b in Section 2.6.3;

4. To minimize the adverse effect from conversion of intertidal and shallow subtidal habitat to deeper water (adverse effect No. 4), implement Terms and Conditions 4a in Section 2.6.3;

5. To minimize the adverse effect from placement of riprap (adverse effect No. 5), implement Terms and Conditions 4.b - 4.c in Section 2.6.3;

6. To minimize the adverse effect from suspension of sediments during dredging (adverse effect No. 6), implement Terms and Conditions 6.a - 6.b in Section 2.6.3;

7. To minimize the adverse effect from scour of substrate (adverse effect No. 7), implement Terms and Conditions 7.a - 7.b in Section 2.6.3;

8. To minimize the adverse effect from graving dock operations (adverse effect No. 8), implement Terms and Conditions 8.a - 8.i, except for 8.i.iii and 8.i.v, in Section 2.6.3;

9. To minimize the adverse effect from accidental spills of fuels and lubricants (adverse effect No. 9), implement Terms and Conditions 9.a - 9.d in Section 2.6.3;

10. To minimize the adverse effect stormwater discharge into HC (adverse effect No. 10), implement Term and Condition 10 in Section 2.6.3.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), the FHWA is required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The FHWA must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(l)).

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